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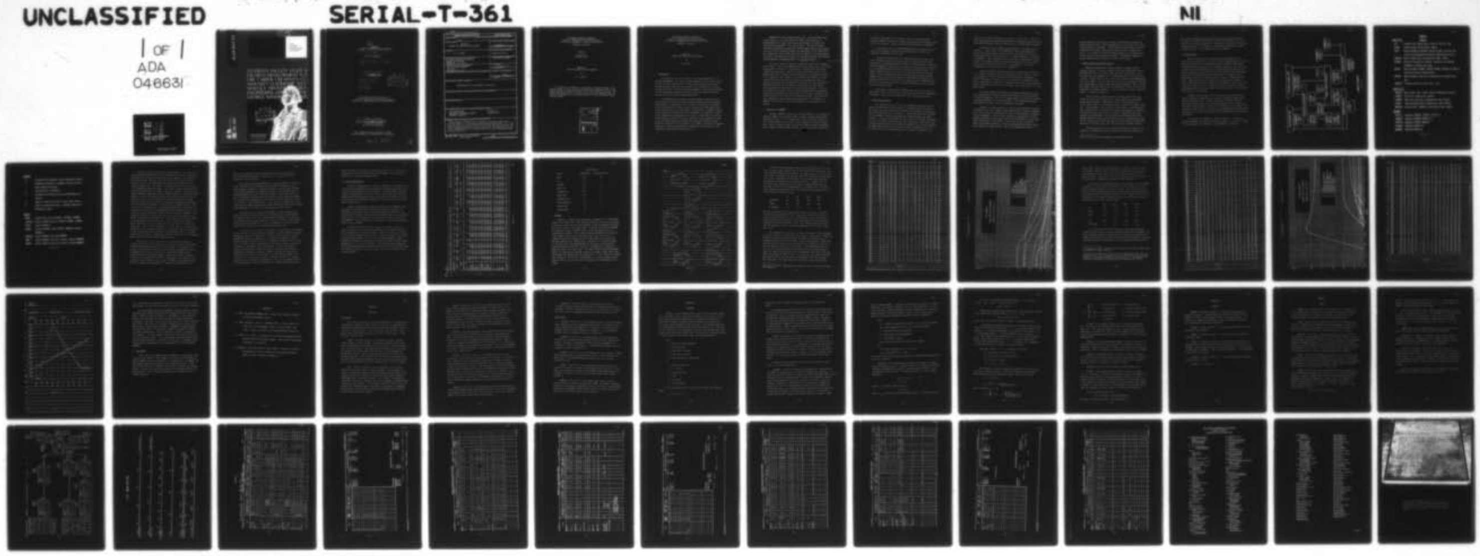

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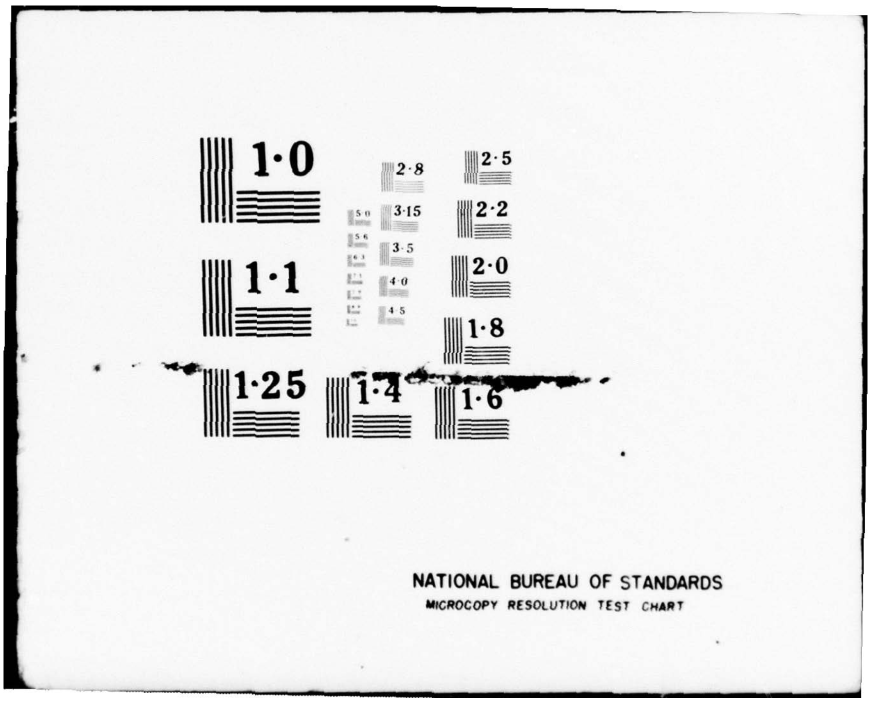
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HOWGOZIT:
A MODEL FOR NAVAL AVIATION TRAINING.

by

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Abstract
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HOWGOZIT
A MODEL FOR NAVAL AVIATION TRAINING

by

E. D. Napier

1. Introduction

The mission of the Chief of Naval Air Training (CNATRA) is: "to provide undergraduate pilot training and undergraduate naval flight officer training for Navy, Marine Corps, and Coast Guard personnel and selected foreign nationals; supervise and coordinate the functioning of all naval aviation activities in the Naval Training Command not specifically assigned to other functional commanders; prosecute such other aviation training tasks as the Chief of Naval Training may direct."

The NATRACOM (Naval Aviation Training Command), comprised of over 42 naval aviation activities widely dispersed throughout the southeastern United States, is responsible for the effective and efficient utilization of over $1,400 million in total resources, including 20,000 military and civilian personnel, on an annual budget of $88 million. TRAWINGS (training wings), the next subordinate echelons of NATRACOM, are comprised of three to six TRARONS (training squadrons) colocated at a NAS (Naval Air Station). The NAS maintains the base facilities, provides training support in ground school and flight simulators, and provides certain maintenance support beyond the capabilities of the TRARONS. The TRARONS, consisting of students, instructors, aircraft, maintenance and administrative personnel, are the fundamental organizational training units.

NATRACOM has a well defined product line - pilots and NFOs (Naval Flight Officers). The pilot production lines, which represent the preponderance of the cost of facilities and personnel, are split into three so-called pipelines - jet, prop and helo. CNO (Chief of Naval Operations) specifies the time-phased student inputs and the annual training rates for all pipelines; however, the variability in the availability and capabilities of the student input and the vagaries of the environment that affect training rates so perturb the training pipelines that workloads vary enormously, something analagous to a "pig in a python".

The flow of students through the respective pipelines is managed at three levels: first, at the NATRACOM level where student input is allocated among pipelines according to planned annual training rates and student capabilities (and within a pipeline by base capacities); second, at the TRAWING level where loading between squadrons can be adjusted to remedy a local irregularity and, finally, at the squadron level where the flow of students can be further paced according to the student abilities, the resources available, and the unfilled requirements for phase completions. Experience has shown that the pipelines can easily get out-of-kilter causing undesirable fluctuations in the downstream squadrons. But it is these downstream squadrons that are usually faced with the extraordinary pressures to meet planned training rates or a deficiency in students that usually follows on the heels of an extraordinary effort. The problem is how to manage this interrelated network effectively. The purpose of HOWGOZIT is to provide a tool to assist CNATRA in the solution of this problem.

2. Objectives of HOWGOZIT

The name, HOWGOZIT, reveals its principal objective - to provide an evaluation (HOW) of the progress (GOES) of pilot training toward meeting planned goals (IT). It is of small value to get to the final quarter of the year and discover for the first time an inability to meet the annual goal. What is obviously needed is a method to make continued assessments of the progress toward meeting this goal. This necessitates a capability

to forecast requirements for aircraft, instructors, and maintenance personnel needed to sustain the student flow and determine whether students will be bottlenecked. These are the principal objectives of HOWGOZIT.

The principal user is the NATRACOM Headquarters although the techniques can be applied at the wing and squadron level for their own evaluation of HOWGOZIT at their level.

The model should identify the constraining resource based on the actual operating experience of each squadron. Hopefully with forecast information of expected workloads and projected availabilities of resources, squadron commanders should permit operation to avoid impending bottlenecks by accelerating/decelerating rates of training at opportune times. For CNATRA, HOWGOZIT should act to locate critical and slack resources and assist in any realignment necessary to minimize underutilized resources. HOWGOZIT should also provide a method for comparing the productivity of wings and pipelines and verification of planning factors. HOWGOZIT should assist in controlling the tempo of training through allocation of flying hours and operating funds.

Underlying the development of HOWGOZIT was an effort to limit the collection of data to that for which there had already been an established requirement. This poses some difficulties which are mentioned later.

3. Related Developments

For a number of years as part of the budgetary processes the staff members of CNET (Chief of Naval Education and Training) have calculated the student input and flight hour requirement using planning factors which have evolved through years of experience. Their work sheets are a network-like arrangement of boxes representing the sequential phases of flight training. A copy of a work sheet for fiscal year 1976 is shown in Appendix E. This form clearly shows important data in the proper input-output relationships between phases and was adopted in HOWGOZIT as one form of display. The CNET approach does not lend itself further as a HOWGOZIT since it is not dynamic or self-correcting and does not account for imbalances that

might exist in student loading at the start of a fiscal year. There are also some problems with differing definitions of planning factors and statistical data apparently having the same name; e.g., average weeks to complete.

In another effort to improve the management of training resources, Captain R. J. Smith, when he was COMTRAWING 3, developed nomographs to display the balance between training resources and student load based on the planning factors used by CNET staff. A sample nomograph is contained in Appendix E. These nomographs gave a good visual representation of the extent of any imbalance between resources existing at the time but had no facility for forecasting the duration of any imbalance. As such the nomographs were of limited utility in a HOWGOZIT.

The most extensive and potentially useful related work is reported in the Dynamic Integrated Facilities Requirements Study (IFRS) [1], which is an outgrowth of studies done by Operations Research, Incorporated. Dynamic IFRS appears to embrace most of the objectives of HOWGOZIT except that is extrapolates on the basis of planning factors rather than experience. Dynamic IFRS might have found a wider audience had it been easier to use and more credible.

The Dynamic Student Flow Model [2], developed separately, is meant to be substituted for Student Flow Model used herein for the calculation of student throughput. The use of a simpler model was dictated by a desire to exercise HOWGOZIT in an interactive mode. Where comparisons between these models were made, the correspondence has been good.

Finally, in a paper prepared as a part of the professional military comptroller course [3], Commander Govan concluded that "students graduated" is of little value for determining efficiency or effectiveness of training resource management. This is easily confirmed in the analysis of weekly aviation statistical reports where the number of graduates in a week bears little relationship to the number of hours flown in the same period. Within the training squadrons, scheduling and maintenance officers orient their thinking to number of hops. This has a disadvantage because of

varying lengths of hops and the inclusion of overhead hours along with direct production hours. These disadvantages are not present when student syllabus hours are considered. Student syllabus hours account for direct utilization of aircraft, student, and instructor time in production of pilots. It is probably the most meaningful measure of work contained in the statistical data now regularly reported. Accordingly, HOWGOZIT has adopted student syllabus hours as its basic unit of work.

4. Weekly Aviation Statistical Reports

CNATRA has required all training squadrons to submit weekly[1] training statistics. These are compiled within the CNATRA staff and are published some three to six weeks after the close of the period. They are relatively good snapshots of the training process, but need some sort of model to relate them as a flow. While the statistics are comprehensive in certain respects, they are deficient in a strict accounting for students and provide almost no data to assess maintenance workload. And, of course, more timely statistics are required for them to be useful in the real time management of training resources. A copy of a weekly aviation statistical report is contained in Appendix F.

About 18 months of data extracted from these reports have been reduced to punch cards and analyzed to derive significant relationships between major variables. Among items of note in the analysis are: (1) that there seems to be a perpetual state of agitation in flight training - a new syllabus, a new aircraft, a base closure, a new PTR (annual pilot training rate); (2) that there are peaks and valleys in utilization of aircraft and instructors that are related to something other than daylight hours and weather; (3) that there are shallower swings in the student instruction rate (student syllabus hours per student-flyable day) and (4) finally, that without some model it is not possible to make early detection of variation in the flow rate through the training pipeline.

Another deficiency in the statistical reporting is evident in the inability to determine how near to completion the various students are.

[1]This report has since been changed to a semi-monthly report.

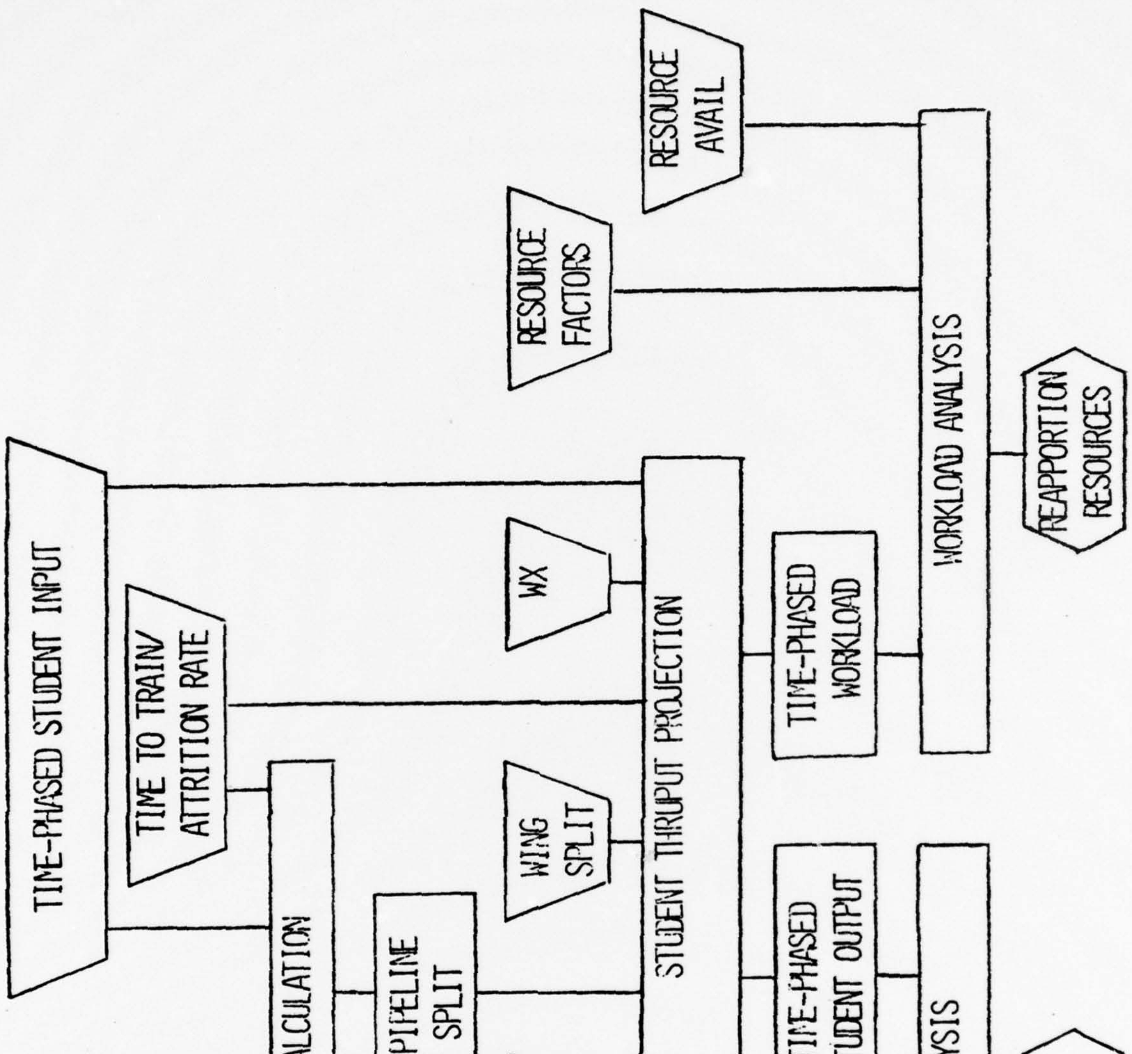
Early in 1976, CNATRA requested a one-time report from all squadrons of the number of students by the number of hops to be completed. The data showed a rather uneven progression to completion but provided the basis for an assumption that on the average a student under instruction is halfway through the course. This assumption is used in HOWGOZIT.

5. Model Overview

From the requirement for appropriate information upon which to manage and the availability of statistical data, a methodology has evolved. It basically consists of entering the data now submitted in the Weekly Aviation Statistical Reports into an automated data base. There the data is merged with prior experience data to provide moving averages and new points of departure for projection of student loading in the coming months. Projections are based upon the time-phased input of students from the predecessor phase and the assumption that the rate of training will continue. These projections are compared with the PTR and the status, in terms of weeks ahead or behind schedule, is determined. Additionally, the resources required to meet the training load are calculated as a demand and compared with the resource supply to determine excess or shortfall and the duration of any imbalance.

HOWGOZIT maintains data bases of planned student input and pilot output, projected availabilities of resources, historical usage factors, and current student loads. Updates, based upon the Weekly Aviation Statistical Reports, and other occasional changes, such as a revision to the student input schedule, cause specific programs to be executed. These programs, in turn, result in a series of routine displays and output file generation. The output files may be used for additional non-routine query and display.

The schematic of HOWGOZIT is shown in Figure 5.1. The files, programs, displays and updates are listed in Figure 5.2. Details of these files and programs are contained in the Appendices A through D.



HOWGOZIT SCHEMATIC

Figure 5.1

HOWGOZIT

INPUT FILES	CONTENTS
PTR	PLANNED PILOTS COMPLETIONS BY PIPELINE, SERVICE, YEAR.
STUDIN	PLANNED STUDENT INPUT BY WEEK, SOURCE.
TRAIN	MOVING AVERAGES OF SSH/SFD, COMPLETIONS/SSH, ATTRITES/ COMPLETION, AND ACCELERATION FACTOR BY ORGANIZATION, SERVICE.
STUDLOAD	ACTUAL STUDENT LOAD BY ORGANIZATION, WEEK, SERVICE.
RESAVAIL	PROJECTED AVAILABILITY AIRCRAFT, INSTRUCTORS, MAINTENANCE PERSONNEL BY ORGANIZATION, WEEK.
RESFACT	MOVING AVERAGES IFH/SSH, IFH/IFD, AFH/SSH, AFH/AFD, AFH/MMH AND EFFICIENCY FACTOR BY ORGANIZATION.
WEATHER	MOVING AVERAGE FLYING DAYS/ SCHEDULED DAYS BY ORGANIZATION, WEEK.
WINGSPLIT	PIPELINE FRACTION BY WING, SERVICE, WEEK.

OUTPUT FILES	
STUDFLOW	MEAN STUDENT INPUT, OUTPUT, LOAD BY ORGANIZATION, SERVICE.
STUDSPLT	FRACTION BY ORGANIZATION, SERVICE.
STUDPROG	WEEKS AHEAD (BEHIND) BY ORGANIZATION, WEEK, SERVICE.
STUDOUT	PROJECTED COMPLETIONS BY ORGANIZATION, WEEK, SERVICE.
WORKLOAD	PROJECTED SSH, STUDLOAD BY ORGANIZATION, WEEK, SERVICE.

PROGRAMS	
PIPEFILL	GENERATES STUDFLOW, STUDSPLT, DISPLAY 1.
PROGRESS	GENERATES STUDPROG, DISPLAY 2,3.
STUDTHRU	GENERATES STUDOUT, WORKLOAD.
STUDANAL	GENERATES DISPLAY 4,5.
WORKANAL	GENERATES DISPLAY 6.

Figure 5.2a

DISPLAYS

1	FLOWGRAPH WITH INCREMENTAL INPUTS REQUIRED BY SERVICE.
2	FLOWGRAPH FY MOVEMENT OF STUDENTS TO DATE WITH WEEKS AHEAD (BEHIND) BY SERVICE.
3	JET/PROP DETAIL OF DISPLAY 2.
4	FLOWGRAPH WITH PROJECTED FLOW WITH PTR SHORTFALL BY SERVICE.
5	TABULAR LISTING PILOT OUTPUT BY WING, WEEK, SERVICE.
6	GRAPH OF RESOURCES AVAILABLE - RESOURCES REQUIRED BY ORGANIZATION, WEEK.

UPDATES

NUPTR	UPDATES PTR; EXECUTES PIPEFILL, STUDTHRU, STUDANAL.
NUSTUDIN	UPDATES STUDIN; EXECUTES STUDTHRU, STUDANAL, WORKANAL.
NUSPLT	UPDATES WINGSPLT.
NUWASR	UPDATES STUDLOAD, TRAIN, RESFACT, WEATHER; EXECUTED PROGRESS.
NURESAVL	UPDATES RESAVAIL; EXECUTES WORKANAL.
NUEFF	UPDATES RESFACT (EFFICIENCY FACTOR); EXECUTES WORKANAL.
NURATE	UPDATES TRAIN (ACCELERATION FACTOR); EXECUTES WORKANAL.

Figure 5.2b

There are basically three routes through HOWGOZIT. The first route approximates what CNET staff does for sizing the student input requirements. Beginning with the output desired from the final phases of each pipeline, mean flows and mean loads are calculated in the program called PIPEFILL. The annual input to the final phases are equal to the output plus any change in student load. The input to the final phases also are the output of the immediate predecessor phases. This process is then repeated for all predecessor phases until the original inputs are reached. If any deficiency between planned student inputs and the number required to fill the pipelines appears, it will be arbitrarily assigned to the input of Aviation Officer Candidate School as the one which has the greatest latitude for change. PIPEFILL also calculates the fraction of students completing primary which enter the respective pipelines. This method of calculating inputs is only a first cut at feasibility of a PTR and misunderstanding of this point has contributed to some grief in the management of the training pipeline. To elaborate on this point, when it takes a year or more for a student to flow through the system, the inputs during any one year have no effect on the number of graduates in that same year. If the pipeline is properly loaded at the beginning of the year and there is not a great deal of change to the PTR from year to year, an input sized to the output will not hurt the system much. However if the pipeline is too lean, there is a limit in the amount which can be graduated regardless of the student input. Calculations of input requirements which ignore the initial student load (i.e., assume steady state) may result in aggravated conditions especially if the training experience departs much from the planning factors.

The next step in the first route is to simulate the movement of students through each phase according to the characteristics of that phase. The Dynamic Student Flow Model [2] is such a model. For demonstration purposes a more elementary model based on transition probabilities served as STUDTHRU and was used to calculate the time-phased student output. STUDTHRU assumes that students progress through the system at an average rate which is controlled by the flight syllabus and at this point not constrained by other resources. The output of STUDTHRU is compared with the PTR in the program called STUDANAL. If shortfall is predicted at this

point, it is assumed that the CNO would be advised of the infeasibility and the PTR would be adjusted as appropriate. A feasible PTR is the objective of the first route.

The second route through HOWGOZIT is to assure adequacy of resources. Given a feasible PTR, the student population under instruction at each phase generates a demand for training resources - the time-phased workload. In the program WORKANAL, the time-phased demand for training resources is compared graphically with the time-phased supply. With a presentation of both the magnitude and duration of any imbalance between supply and demand, it is expected that management at each echelon will take appropriate action to alleviate or avert the bottleneck. Since there are a myriad of possible conditions and options available and without more solid cost-benefit relationships, HOWGOZIT is not capable of identifying any optimal action.

The third route is the heart of HOWGOZIT. On the assumption that CNO has prescribed a feasible PTR and that CNATRA has allocated students and training resources in a near optimal fashion, HOWGOZIT then evaluates the progress by phase toward completion of the PTR in terms of weeks ahead or behind the expected production. With such information it becomes clearly evident where acceleration or deceleration should take place.

At this point a few words on the subject of acceleration and efficiency may be in order. Time-to-train may be reduced by simply pushing the student through the system at a faster rate. This will result in smaller student populations (with some reductions in the amount paid students as salary during training) and some possibility of economies in support costs if, and only if, support personnel and support facilities are actually curtailed in proportion to the smaller student populations. The real efficiencies result only when higher average utilization of aircraft, instructors, and maintenance personnel are achieved. HOWGOZIT includes an acceleration factor in the TRAIN file as a variable bias to the moving average of the training rate - student syllabus hours per student flyable day. An efficiency factor is included in the RESFACT file for use as a variable bias to the moving average of the utilization ratios - student syllabus hours per

aircraft flyable day and student syllabus hours per instructor flyable day. Judicious use of these factors should enable CNATRA to set the tempo of operation at a high but achievable level.

6. Concept Demonstration

In order to demonstrate the concept of HOWGOZIT in a meaningful way, a scenario was developed which approximated the expected transition of the current UPT (undergraduate pilot training) to the NIFTS (Navy Integrated Flight Training System) in the fall of 1976. The scenario was drawn from fragmentary information gathered by the research team and does not necessarily reflect the intentions of NATRACOM. Details of the scenario can be found in Reference [2].

Certain representative programs and displays of the HOWGOZIT were programmed on the Hewlitt-Packard 3000 minicomputer at the School of Engineering and Applied Science, The George Washington University. The construction of the data files and update programs remains to be completed; however, there is sufficient reason to believe the concept is sound and that HOWGOZIT can be programmed on a minicomputer or time-sharing computer system, such as INFONET.

The Weekly Aviation Statistical Report of 21 March 1976 was the latest available at the time of the demonstration (late April) and is the point of departure for the HOWGOZIT runs. Figure 6.1 contains a printout of certain data derived from this report which would regularly be included in the TRAIN and RESFACT files of a fully automated HOWGOZIT. Data is presented by squadron (in pairs when colocated at an NAS) and other upward aggregations. It is of some interest to note the difference between the attrition experienced and the planning factors shown in the following table. This difference accounts in part for some of the current leanness in the training pipeline.

RUN
EDMBA

FOLLOWING DATA IS FROM 21 MARCH 76 WEEKLY AVIATION STATISTICAL REPORT APR 16, 1976, 12:21 PM

WASR COL	14	15	16	13	30	35	37	42	44							
NAME	STUD COMP	AVE WKS	AVE HRS	STUD ATTR	STUD SYLHR	INST SYLHR	AVIA TOTHR	A/C SYLHR	A/C TOTHR	TRAIN RATE	SSH/ COMP	ATTR RATE	IFH/ SSH	INST/ STUD	AFH/ SSH	A/C/ STUD
VAR	A	B	C	D	E	F	G	H	J	E/B*A+D/2	E/A	D/A+D	G/E		J/E	
SQUAD																
AOCS	131	11.4	.0	26	0	0	0	0	0	.000	.0	.125	.000	.000	.000	.000
EI	948	3.5	.0	19	0	0	0	0	0	.000	.0	.020	.000	.000	.000	.000
VT1/5	949	5.3	28.5	107	29947	24653	34029	29947	36396	5.623	31.6	.101	1.135	.581	1.215	.427
VT4(B)	36	34.9	123.2	7	3620	3173	5575	3970	6331	2.622	100.6	.163	1.540	.396	1.749	.358
VT9/19	94	22.5	105.2	9	12289	10616	16455	13205	16254	5.539	130.7	.087	1.339	.727	1.323	.572
VT23	116	27.6	113.9	15	13456	11340	17451	14839	18140	3.945	116.0	.115	1.297	.502	1.348	.415
VT26	125	22.1	103.7	20	14392	11636	18982	15356	19085	4.817	115.1	.138	1.319	.623	1.325	.479
VT4(A)	44	32.9	127.0	4	5713	4872	6319	6769	8032	3.769	129.8	.083	1.106	.463	1.406	.403
VT7	78	19.4	120.3	13	9502	8832	12699	11679	13824	5.734	121.8	.143	1.335	.859	1.455	.617
VT21/22	99	20.2	117.9	6	14261	11437	17503	17038	20695	6.934	144.1	.057	1.227	.946	1.451	.774
VT24/25	110	20.9	119.8	14	15443	13151	19266	19337	22584	6.316	140.4	.113	1.248	.875	1.462	.710
VT3	158	19.8	100.6	39	14808	13366	17143	14990	17134	4.220	93.7	.198	1.158	.432	1.157	.349
VT27	185	20.9	92.3	22	16487	15449	18238	15840	18410	4.025	89.1	.106	1.106	.394	1.117	.321
VT28/31	278	15.4	85.8	10	27799	24874	31582	26359	29938	6.384	100.0	.035	1.135	.625	1.077	.458
VT2/6	335	22.0	100.6	61	31817	28658	39026	32659	38983	3.952	95.0	.154	1.227	.429	1.225	.345
HT8	332	6.4	36.6	2	12239	10699	13986	12241	14333	5.761	36.9	.006	1.143	.549	1.172	.432
HT18	351	10.2	65.4	17	24282	24282	32670	24232	28767	6.641	69.2	.046	1.345	.770	1.135	.629
BJ	371	25.2	109.2	51	43757	36765	53463	47370	59810	4.381	117.9	.121	1.336	.574	1.367	.453
AJ	331	21.9	120.3	37	44919	38292	55787	54873	65135	5.859	135.7	.101	1.242	.808	1.450	.653
BP	343	20.4	96.1	61	31295	28815	35381	31830	35544	4.111	91.2	.151	1.131	.411	1.136	.334
TW6	44	61.5	227.8	11	9333	8045	11894	10739	14363	3.064	212.1	.200	1.274	.411	1.539	.365
TW1	78	46.6	247.0	22	21791	19448	29154	24884	30078	5.256	279.4	.220	1.338	.740	1.380	.552
TW2	99	52.5	251.3	21	27717	22777	34954	31927	39835	4.819	280.0	.175	1.261	.640	1.401	.523
TW3	110	46.0	237.7	34	29835	24787	38248	34693	41669	5.102	271.2	.236	1.282	.698	1.397	.552
NATRACOM	960	53.5	242.7	391	246055	217038	300924	259561	308916	3.979	256.3	.289	1.223	.487	1.255	.352

Figure 6.1

	ATTRITION RATE	
PHASE	EXPERIENCED	PLANNING FACTOR
AOCS	12.6	10
EI	2.0	2
PRIMARY	10.1	8
BASIC JET	12.1	10
ADVANCED JET	10.1	4
BASIC PROP	15.1	14
ADVANCED PROP	3.5	2
BASIC PROP/HELO	15.4	14
PRIMARY HELO	.6	1
ADVANCED HELO	4.6	1

7. Results

Figure 7.1, similar to the work sheet in Appendix E, is the HOWGOZIT display for 21 March 1976. This display represents the fiscal year movement of students to date with the status (number of weeks ahead/behind schedule) shown in the center of the larger boxes. Using the box labeled "NATRACOM" as a guide and reading clockwise around the box the numbers are to be interpreted as follows: 1,373 students entered NATRACOM this fiscal year; 1,766 students were on board at the beginning of the fiscal year; 391 students have attrited during the year; 1,788 students are now on board; 960 have completed; the average time to completion was 52.9 weeks (based on a 50-week year); and that NATRACOM as a whole was 4.0 weeks behind schedule meeting the FY76 PTR. Details of the HOWGOZIT by pipeline and phase are shown in the other boxes. The smaller boxes interspersed between phases are student pools awaiting training, the numbers inside these boxes representing the beginning and end populations. In this display all students were considered. In the full blown HOWGOZIT, it is expected that the user would be able to call out the source of students to be displayed in this format.

```
RUN
EDN7A
                I 245                            I 1128
        +-------V-------+                +-------V-------+
        IAOC          47I                IEI           54I
        I               I                I               I
        I -24.5 WKS     > 26             I  +2.2 WKS     > 19
        I               I                I               I
        I11.4         85I                I 3.5         138I
        +-------V-------+                +-------V-------+
                I 181                            I 1025
                +----------------+----------------+
                                 I 1206
                         +-------V-------+
                         IPRI         124I
                         I               I
                         I  -5.6 WKS     > 107
                         I               I
                         I 5.3         192I
                         +-------V-------+
                                 I 1031
                         +----+  I
                         I   7I  I
                         I   7I--+
                         +----+  I 1031
        +------------------------+------------------------+
        I 455                    I 275                    I 301
+----+  I                +----+  I                +----+  I
I  40I  I                I 112I  I                I  52I  I
I  26I--+                I  54I--+                I  26I--+
+----+  I 469            +----+  I 333            +----+  I 327
+-------V-------+        +-------V-------+        +-------V-------+
IBJ          272I        IBP          245I        IBP/H        287I
I               I        I               I        I               I
I  -3.1 WKS     > 51     I   +.0 WKS     > 61     I  -5.8 WKS     > 61
I               I        I               I        I               I
I25.4        306I        I20.4        153I        I22.0        222I
+-------V-------+        +-------V-------+        +-------V-------+
        I 384                    I 364                    I 331
+----+  I                +----+  I                +----+  I
I  48I  I                I  17I  I                I   0I  I
I  32I--+                I   5I--+                I   3I--+
+----+  I 400            +----+  I 376            +----+  I 328
+-------V-------+        +-------V-------+        +-------V-------+
IAJ          195I        IAP           72I        IPH           64I
I               I        I               I        I               I
I  -5.1 WKS     > 37     I   +.5 WKS     > 10     I  -4.4 WKS     > 2
I               I        I               I        I               I
I22.1        227I        I15.4        160I        I 6.4         58I
+-------V-------+        +-------V-------+        +-------V-------+
        I 331                    I 278                    I 332
                                                  +----+  I
                                                  I  25I  I
                                                  I   7I--+
                    I 1373                        +----+  I 350
            +-------V-------+                     +-------V-------+
            INATRACOM   1766I                     IAH          105I
            I               I                     I               I
            I  -4.0 WKS     > 391                 I  -3.4 WKS     > 17
            I               I                     I               I
            I52.9       1783I                     I10.2         87I
            +-------V-------+                     +-------V-------+
                    I 960                                 I 351
```

Figure 7.1

With only 14 weeks between 21 March 1976 and the end of the fiscal year, it looked quite unlikely that the jet and helo PTR could be met since the predecessor phases are also behind. For some reason, not clear at this point, some 112 students were awaiting basic prop training at the beginning of the year. Undoubtedly, the existence of this large group prejudiced the chances for meeting the jet and helo PTR later. It might also be noted that weekly projections of the number of completions by pipelines were made in a run of the STUDTHRU model on 11 November 1975. The table below compares the projection for 21 March 1976 with that reported in the Weekly Aviation Statistical Report.

	JET	PROP	HELO	TOTAL
PROJECTED	341	262	352	955
ACTUAL	331	278	351	960
DIFFERENCE	-10	+16	-1	+5

The same run projected 1313 completions for the fiscal year, a shortfall of 232 from the stated PTR of 1545. Subsequent revision of the PTR to 1435 reduced the shortfall by 110. But the point is that as far back as November there were warnings that the student population was incapable of supporting a PTR much in excess of 1313. The current projections, based upon the 21 March statistics, show 1360 completions for the year, a shortfall of 75.[2]

Next, HOWGOZIT was exercised to project the windup of UPT considering no further inputs to the system after the week of 27 August 1976. Figure 7.2 displays the populations of each phase (including the terminal states of designated pilots or attrites) by week. Week is designated by a three digit code where the first digit is the last digit of the calendar year and the last two digits are the weekly report number. (The NATRACOM year has only 50 weeks since training ceases for two weeks over the Christmas Season.) Figure 7.3 graphs the populations under training and shows rather long tails before the populations drop to zero. At first these tails were viewed with some suspicion since they are a direct consequence of the way the model was constructed. Will some students be around this long after input has

[2] The actual shortfall experienced for FY76 was a total of 60 in the jet and helo pipelines.

>RUN
WINDUP1

WEEK	PRI	PPRI	PJET	BASJ	ADVJ	PPRP	BASP	ADVP	PHEL	BP/H	PRIH	ADVH	JET	PROP	HELO	ATTR
612	192	39	3	320	258	2	200	151	3	233	60	91	312	298	350	401
613	173	37	15	310	258	9	191	153	14	240	59	91	352	290	350	412
614	157	35	15	313	257	8	191	155	14	233	53	94	363	309	377	422
615	151	34	14	316	255	8	170	155	13	235	53	91	373	318	386	432
616	157	33	14	317	256	8	149	151	13	239	53	91	384	329	395	443
617	153	32	13	319	255	8	137	143	12	241	57	91	391	338	404	453
618	150	32	13	319	255	7	135	145	12	242	57	93	405	317	412	463
619	148	31	13	320	255	7	184	144	12	243	57	93	415	356	421	473
620	146	31	13	320	254	7	182	142	12	244	57	93	425	365	430	483
621	144	31	12	320	254	7	181	140	11	244	57	93	435	374	438	492
622	143	30	12	320	254	7	179	138	11	245	57	93	447	383	447	502
623	142	30	12	319	253	7	177	137	11	245	53	92	457	392	456	512
624	141	30	12	319	253	7	175	135	11	245	53	92	467	401	461	522
625	141	30	12	318	253	7	174	133	11	245	53	92	473	409	473	531
626	140	30	12	318	253	7	172	131	11	245	53	92	10	8	0	10
627	140	30	12	317	252	7	171	130	11	245	53	92	21	17	17	19
628	139	29	12	316	252	7	169	128	11	244	59	92	31	25	26	29
629	139	29	12	316	252	7	168	127	11	244	53	92	41	33	34	39
630	139	29	12	315	251	7	166	126	11	244	53	92	52	41	43	43
631	138	29	12	315	251	7	165	124	11	244	53	92	62	49	51	58
632	138	29	12	314	251	7	163	122	11	244	53	92	72	57	60	67
633	138	29	12	313	250	7	162	121	11	243	53	92	83	64	69	77
634	138	29	12	313	250	7	161	119	11	243	59	92	93	72	77	86
635	138	29	12	312	250	7	160	118	11	243	58	92	103	80	86	96
636	138	29	12	311	249	7	159	117	11	243	59	92	114	87	94	105
637	138	29	12	311	249	7	158	115	11	243	59	92	124	95	103	114
638	133	29	12	310	249	7	157	114	11	242	59	92	134	102	111	124
639	112	24	12	310	248	7	156	113	11	242	53	92	10	7	9	9
640	91	19	9	309	248	5	155	112	9	242	59	92	20	14	17	17
641	74	16	8	307	248	4	153	111	7	240	57	92	31	21	26	25
642	60	13	6	302	247	4	150	110	6	236	57	91	41	29	34	33
643	48	10	5	297	247	3	146	109	5	231	57	91	51	35	43	41
644	36	8	4	290	246	2	142	103	4	225	57	91	61	42	51	51
645	24	6	3	283	245	2	137	106	3	219	56	91	71	49	60	63
646	12	4	2	275	244	1	132	105	2	212	56	91	81	56	68	77
647	0	2	2	266	242	1	127	103	2	204	55	91	91	62	77	92
648	0	0	1	258	241	0	122	102	1	197	54	90	101	69	95	98
649	0	0	0	248	239	0	116	100	0	193	53	90	111	75	94	104
650	0	0	0	238	237	0	111	93	0	180	51	82	121	82	102	109
701	0	0	0	229	234	0	105	95	0	172	50	93	131	98	110	114
702	0	0	0	220	232	0	100	91	0	164	49	87	140	94	118	119
703	0	0	0	211	229	0	95	92	0	156	47	86	150	100	127	124
704	0	0	0	203	226	0	90	90	0	149	45	85	159	106	135	129
705	0	0	0	195	223	0	36	83	0	143	44	84	169	112	143	133
706	0	0	0	187	220	0	82	85	0	136	42	83	178	117	150	138
707	0	0	0	180	216	0	78	83	0	130	41	81	187	122	158	142
708	0	0	0	173	213	0	74	81	0	123	39	79	195	128	166	147
709	0	0	0	166	209	0	70	79	0	117	38	78	204	133	173	152
710	0	0	0	160	206	0	66	76	0	110	36	76	213	138	180	157
711	0	0	0	153	202	0	62	74	0	104	34	74	221	143	187	163
712	0	0	0	147	198	0	59	72	0	97	33	72	229	147	194	169
713	0	0	0	140	194	0	54	69	0	91	31	70	238	152	201	175
714	0	0	0	134	191	0	51	67	0	84	30	68	246	156	208	184
715	0	0	0	128	187	0	47	65	0	78	29	66	253	160	214	192
716	0	0	0	121	183	0	43	62	0	71	27	64	261	165	220	201
717	0	0	0	115	179	0	39	60	0	65	25	62	269	168	226	210
718	0	0	0	109	175	0	35	58	0	58	24	60	276	172	232	220
719	0	0	0	102	170	0	31	55	0	52	22	58	283	176	237	231
720	0	0	0	96	166	0	27	53	0	45	21	55	290	179	243	242
721	0	0	0	89	162	0	23	51	0	39	19	53	297	183	248	254
722	0	0	0	83	158	0	19	48	0	32	18	51	304	186	253	266
723	0	0	0	77	154	0	16	46	0	26	16	49	310	189	258	279
724	0	0	0	70	149	0	12	44	0	19	14	46	316	192	262	292
725	0	0	0	64	145	0	8	41	0	13	13	44	323	195	266	306
726	0	0	0	57	141	0	4	39	0	6	11	42	328	197	271	321
727	0	0	0	51	136	0	0	36	0	0	10	39	334	200	274	335
728	0	0	0	45	132	0	0	34	0	0	9	37	340	202	278	341
729	0	0	0	38	128	0	0	32	0	0	7	35	345	204	282	347
730	0	0	0	32	123	0	0	30	0	0	6	32	351	206	285	353
731	0	0	0	26	119	0	0	28	0	0	4	30	356	208	288	360
732	0	0	0	19	114	0	0	26	0	0	3	28	360	210	291	367
733	0	0	0	13	110	0	0	24	0	0	1	25	365	212	293	374
734	0	0	0	6	105	0	0	23	0	0	0	23	370	213	296	382
735	0	0	0	0	101	0	0	21	0	0	0	21	374	214	298	389
736	0	0	0	0	96	0	0	20	0	0	0	19	378	216	300	389
737	0	0	0	0	92	0	0	18	0	0	0	17	382	217	301	390
738	0	0	0	0	88	0	0	17	0	0	0	15	386	218	303	390
739	0	0	0	0	84	0	0	16	0	0	0	14	4	1	1	1
740	0	0	0	0	80	0	0	14	0	0	0	12	7	2	3	2
741	0	0	0	0	76	0	0	13	0	0	0	11	10	3	4	3
742	0	0	0	0	73	0	0	11	0	0	0	10	13	4	5	4
743	0	0	0	0	69	0	0	10	0	0	0	9	16	4	6	5
744	0	0	0	0	66	0	0	9	0	0	0	8	19	5	7	7
745	0	0	0	0	62	0	0	7	0	0	0	7	22	6	7	9
746	0	0	0	0	59	0	0	6	0	0	0	6	25	6	8	11
747	0	0	0	0	55	0	0	4	0	0	0	5	27	6	9	14
748	0	0	0	0	52	0	0	3	0	0	0	3	29	7	9	17
749	0	0	0	0	49	0	0	1	0	0	0	2	31	7	9	20
750	0	0	0	0	45	0	0	0	0	0	0	1	33	7	10	24

Figure 7.2

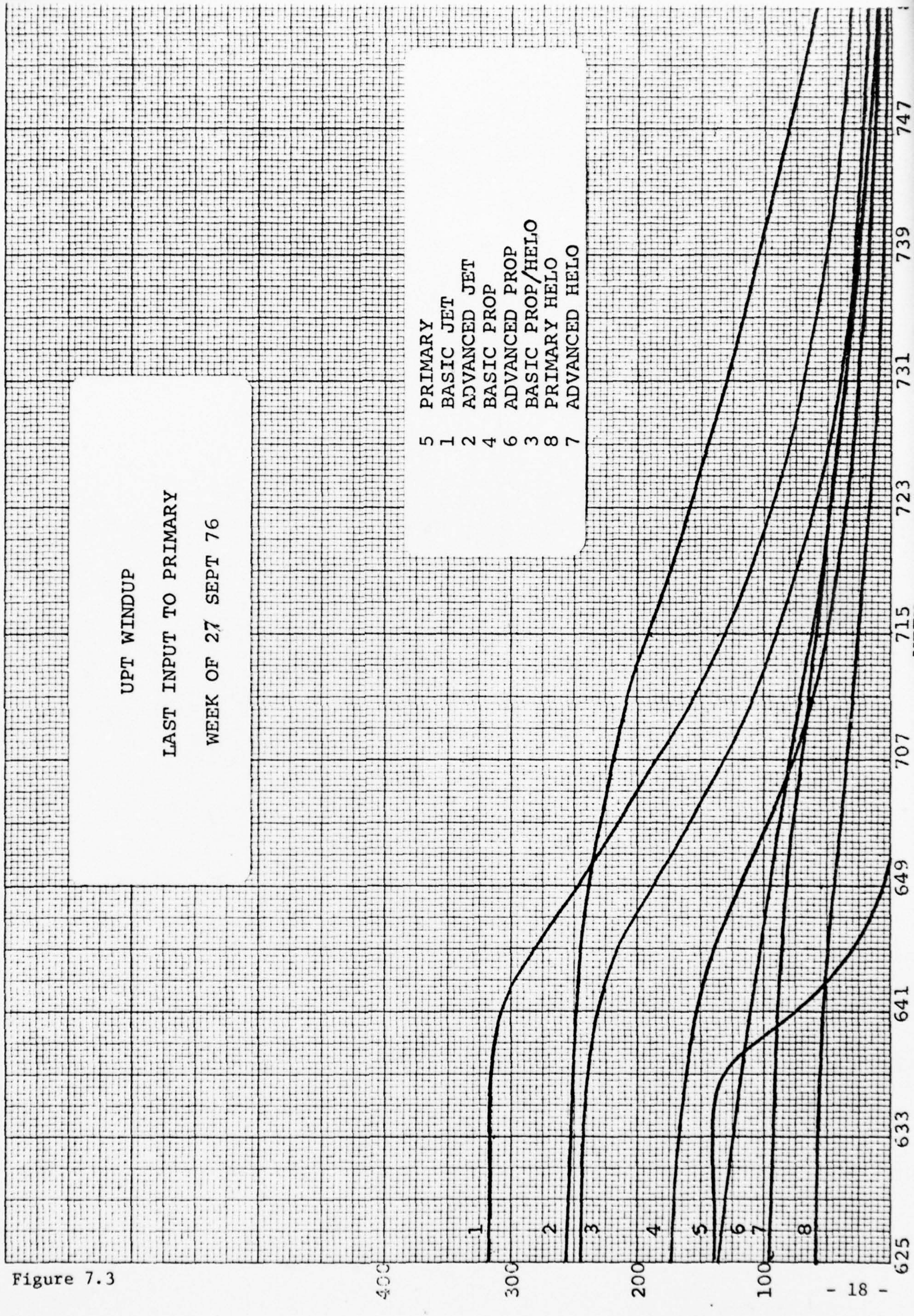

UPT WINDUP
LAST INPUT TO PRIMARY
WEEK OF 27 SEPT 76
5 PRIMARY
1 BASIC JET
2 ADVANCED JET
4 BASIC PROP
6 ADVANCED PROP
3 BASIC PROP/HELO
8 PRIMARY HELO
7 ADVANCED HELO
1
2
3
4
5
6
7
8
625
633
641
649
707
715
723
731
739
747
WEEK
400
300
200
100

Figure 7.3

ceased? While the data on the distribution of times to complete a phase of training is sketchy, there is at least some evidence [4] to show that some students may take twice as long as the average to complete. The suggestion that it might take a long time to shut down the UPT pipeline is one that must be considered in planning the NIFTS transition.

A projection of the NIFTS buildup is shown in Figure 7.4 and graphed in Figure 7.5. The striking characteristic of this buildup is the large growth of the basic phase in the first 16 weeks. This will place a heavy load on the T28 and T34C aircraft and the instructors available, expecially when coupled with the load remaining under the UPT syllabus. The projected completions for FY77 under the combination of the UPT and NIFTS are compared with the PTR in the following table.[3]

	JET	PROP	HELO	TOTAL
UPT	386	218	303	907
NIFTS	34	98	138	270
TOTAL	420	316	441	1177
PTR	555	329	506	1390
DIFFERENCE	-135	-13	-65	-213

It is obvious that the FY77 PTR cannot be met with the present student population even if adequate training resources were available. In order to assess how much of this shortfall is caused by the transition to NIFTS another run was made in which UPT was continued unchanged. The printout shown in Figure 7.6 indicated that the shortfall would still be 102.[4]

---

[3] A comparison of these projections with actual results cannot be made since the scenario was never executed.

[4] The projected completions for FY77 as of 1 September 1977 was 1,251 or a shortfall of 139. While neither the NIFTS or UPT scenarios were executed precisely, the actual circumstances were part of each. The shortfall of 139 was also inbetween the projected 213 for NIFTS and 102 for UPT.

>RUN
BUILDUP

WEEK	BAS	PBAS	PSIK	INTS	ADVS	PHAR	INFR	ADVR	PROT	INTR	PRIR	ADVR	STK	HAR	POT	ATTR
612	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
613	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
615	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
617	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
618	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
619	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
621	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
622	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
623	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
624	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
625	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
626	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
627	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
628	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
629	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
631	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
632	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
633	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
635	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
636	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
637	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
638	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
639	45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
640	99	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
641	132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
642	176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
643	218	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
644	261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
645	303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
646	344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
647	395	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20
648	426	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
649	466	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29
650	506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34
701	531	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
702	555	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45
703	549	31	0	0	0	0	0	0	0	0	0	0	0	0	0	51
704	542	30	12	0	0	7	0	0	11	0	0	0	0	0	0	56
705	537	30	12	12	0	7	7	0	11	11	0	0	0	0	0	62
706	531	30	12	24	0	7	14	0	11	23	0	0	0	0	0	68
707	526	29	12	36	0	7	21	0	11	34	0	0	0	0	0	74
708	521	29	12	48	0	7	28	0	11	44	0	0	0	0	0	80
709	517	29	12	60	0	7	29	5	11	46	9	0	0	0	0	86
710	513	29	12	71	0	7	30	11	11	48	18	0	0	0	0	92
711	509	28	11	82	0	7	30	17	11	49	27	0	0	0	0	99
712	505	28	11	94	0	7	31	23	11	50	36	0	0	0	0	105
713	502	28	11	105	0	7	31	29	10	50	39	7	0	0	0	111
714	498	28	11	115	0	6	32	35	10	51	41	15	0	0	0	117
715	495	28	11	126	0	6	32	41	10	51	42	23	0	0	0	124
716	493	28	11	137	0	6	32	47	10	51	44	31	0	0	0	130
717	490	27	11	147	0	6	32	53	10	51	45	40	0	0	0	137
718	487	27	11	158	0	6	32	59	10	51	46	47	0	0	0	143
719	485	27	11	168	0	6	32	65	10	51	47	53	0	0	0	150
720	483	27	11	178	0	6	32	67	10	51	47	67	0	5	0	156
721	481	27	11	180	8	6	32	68	10	51	48	75	0	9	0	163
722	479	27	11	182	16	6	31	69	10	51	49	77	0	14	7	169
723	477	27	11	184	25	6	31	70	10	50	48	81	0	19	14	176
724	475	27	11	185	33	6	31	71	10	50	49	83	0	24	21	183
725	474	27	11	187	42	6	31	72	10	50	48	85	0	29	29	189
726	472	26	11	188	50	6	31	73	10	50	49	87	0	34	36	196
727	471	26	11	189	59	6	31	74	10	50	48	89	0	39	44	203
728	470	26	11	190	67	6	31	75	10	50	48	90	0	44	52	209
729	468	26	11	191	76	6	31	75	10	49	48	92	0	49	60	216
730	467	26	10	192	84	5	31	75	10	49	48	93	0	55	69	223
731	466	26	10	193	93	6	31	77	10	49	48	94	0	60	77	230
732	465	25	10	194	102	5	30	77	10	49	48	95	0	65	86	236
733	464	26	10	195	110	6	30	77	10	49	49	96	0	71	94	243
734	463	26	10	196	113	5	30	78	10	49	49	97	7	76	103	250
735	463	26	10	196	114	5	30	78	10	49	48	97	13	82	111	257
736	462	26	10	197	116	6	30	78	10	48	48	98	20	87	120	263
737	461	26	10	197	118	6	30	79	10	48	48	99	27	93	129	270
738	460	26	10	198	120	5	30	79	10	48	47	99	34	98	138	277
739	460	26	10	198	121	6	30	79	10	48	47	99	7	6	9	7
740	459	26	10	199	123	6	30	79	10	48	47	100	14	11	18	14
741	458	26	10	199	124	6	30	79	10	48	47	100	22	17	27	20
742	458	26	10	199	126	6	30	79	9	48	47	100	29	22	36	27
743	457	26	10	200	127	6	30	80	9	48	47	100	37	28	45	34
744	457	26	10	200	128	6	30	80	9	48	47	101	44	33	54	41
745	457	26	10	200	129	6	30	80	9	48	47	101	52	39	63	47
746	456	26	10	200	131	6	30	80	9	48	47	101	60	44	72	54
747	456	26	10	201	132	6	30	80	9	48	47	101	69	50	81	61
748	455	26	10	201	133	6	30	80	9	47	46	101	76	56	90	68
749	455	25	10	201	134	6	29	80	9	47	46	101	81	61	99	74
750	455	25	10	201	134	6	29	80	9	47	46	101	92	67	108	81

Figure 7.4

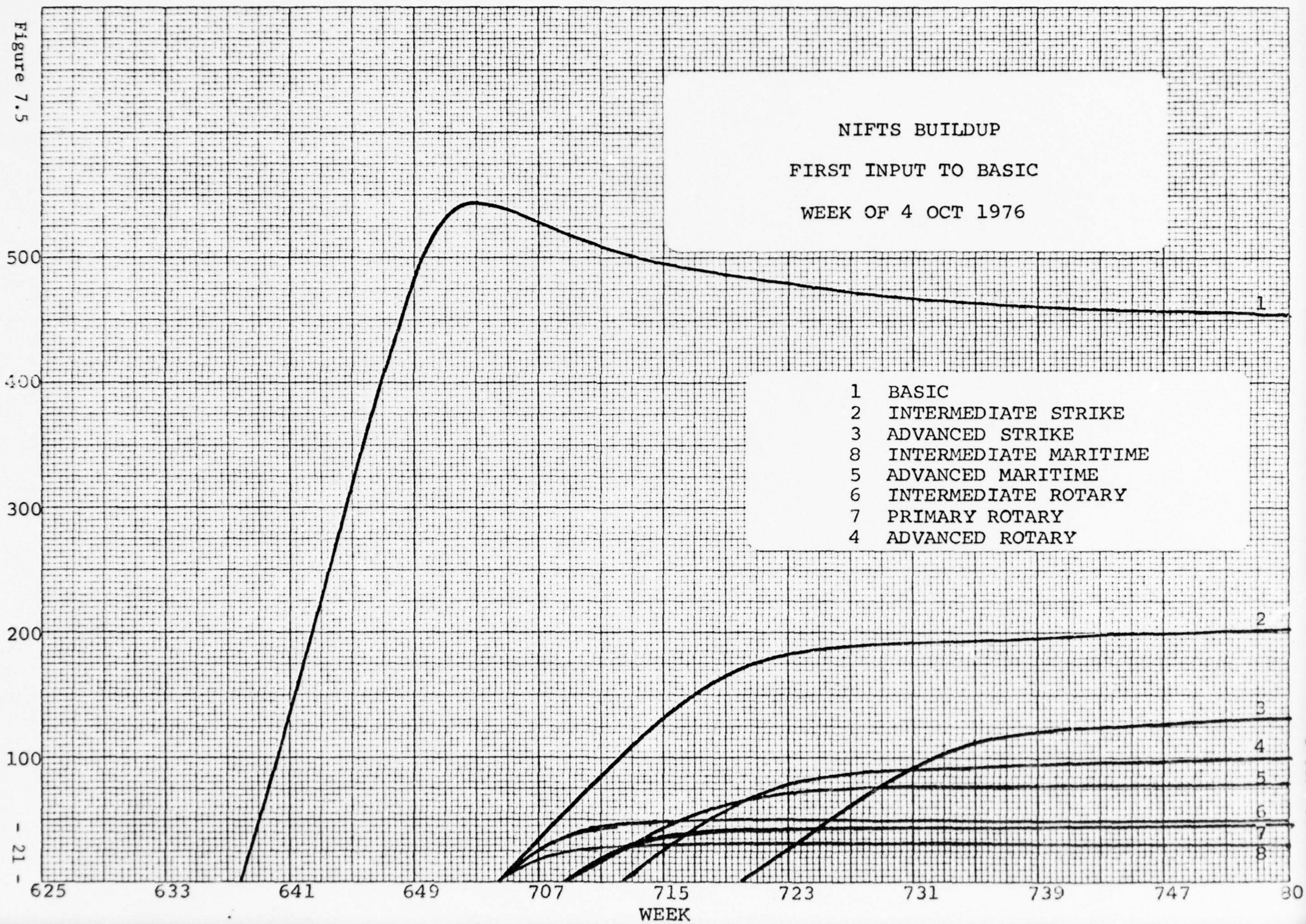

NIFTS BUILDUP
FIRST INPUT TO BASIC
WEEK OF 4 OCT 1976
1 BASIC
2 INTERMEDIATE STRIKE
3 ADVANCED STRIKE
8 INTERMEDIATE MARITIME
5 ADVANCED MARITIME
6 INTERMEDIATE ROTARY
7 PRIMARY ROTARY
4 ADVANCED ROTARY
500
400
300
200
100
625
633
641
649
707
715
723
731
739
747
80
WEEK
1
2
3
4
5
6
7
8

Figure 7.5

MAY 8, 1976, 1:11

WEEK	PRI	PPRI	PJET	BASJ	ADVJ	PPRP	BASP	ADVP	PHEL	BPAH	PAUH	ADVH	JET	PROP	HELO	ATTR
612	192	40	3	320	258	2	230	161	3	236	60	94	342	293	360	402
613	188	40	16	310	257	9	191	157	15	230	60	94	352	298	368	413
614	184	39	16	314	256	9	191	155	15	234	59	94	363	303	377	424
615	176	37	15	317	256	9	191	154	14	231	59	94	373	313	386	434
616	170	35	15	320	255	8	190	152	14	242	59	94	384	328	395	445
617	164	34	14	322	254	8	190	150	13	244	59	94	394	337	404	456
618	158	33	14	323	254	8	188	147	13	246	59	94	405	347	413	466
619	153	32	13	324	254	8	187	146	12	248	59	94	415	356	422	476
620	150	31	13	325	253	7	186	145	12	249	60	94	425	365	430	486
621	147	31	13	325	253	7	184	143	12	249	60	94	436	374	439	496
622	145	30	12	324	253	7	182	141	11	250	60	94	446	383	448	507
623	142	30	12	324	253	7	180	140	11	250	60	94	457	392	457	516
624	141	29	12	323	252	7	178	138	11	249	61	94	467	401	466	526
625	138	29	12	322	252	7	176	137	11	249	61	94	477	409	474	536
626	137	29	12	321	252	7	175	135	11	249	61	95	10	9	9	10
627	136	28	11	320	252	7	173	134	11	248	61	95	21	17	18	19
628	136	29	11	319	251	7	171	132	11	247	61	95	31	25	27	29
629	139	29	11	317	251	7	169	131	11	247	61	95	41	34	35	39
630	143	30	12	316	251	7	167	129	11	246	61	95	52	42	44	49
631	146	30	12	315	250	7	166	128	11	246	61	95	62	50	53	59
632	148	31	12	315	250	7	164	126	11	245	61	95	72	58	62	68
633	150	31	12	314	249	7	163	125	11	246	61	95	82	66	71	78
634	152	32	13	314	249	7	163	124	12	246	61	95	93	74	80	88
635	151	32	13	314	248	7	162	122	12	246	61	95	103	81	89	98
636	148	31	13	315	248	7	161	121	12	247	61	95	113	89	98	108
637	145	30	12	315	248	7	161	120	11	247	61	95	123	97	107	118
638	140	29	12	315	247	7	160	119	11	248	61	95	133	104	116	127
639	137	29	12	314	247	7	159	118	11	243	61	95	10	7	9	10
640	136	28	11	314	247	7	158	117	11	247	61	95	20	15	18	19
641	135	28	11	313	246	7	157	116	10	247	61	95	30	22	27	29
642	138	29	11	312	246	7	156	115	10	246	61	95	41	29	36	38
643	141	30	12	311	246	7	154	114	11	245	61	95	51	37	45	48
644	145	30	12	310	245	7	154	113	11	245	61	95	61	44	54	57
645	150	31	12	309	245	7	153	112	11	244	61	95	71	51	63	67
646	155	32	13	309	245	7	152	111	12	245	61	95	81	58	72	77
647	160	33	13	309	244	7	152	110	12	245	60	95	91	65	81	87
648	164	34	13	310	244	8	152	109	12	246	60	95	101	72	90	97
649	167	35	14	311	243	8	152	109	13	247	60	95	111	79	99	107
650	171	36	14	312	243	8	153	108	13	249	61	95	121	85	108	117
701	174	36	14	314	243	8	153	107	13	250	61	95	131	92	117	127
702	175	37	15	316	243	8	154	107	13	252	61	95	141	99	126	138
703	175	37	15	318	243	8	155	106	14	254	61	95	151	105	135	148
704	179	37	15	320	243	8	156	105	14	255	61	95	161	112	144	159
705	179	37	15	322	243	9	156	105	14	258	61	95	171	119	153	169
706	178	37	15	324	243	9	157	105	14	260	62	95	181	125	161	180
707	175	37	15	326	243	9	158	105	14	262	62	95	191	132	170	190
708	173	36	15	328	243	8	159	104	14	264	62	97	201	138	180	201
709	169	35	14	330	244	8	160	104	13	265	63	97	211	145	189	211
710	164	34	14	331	244	8	160	104	13	267	63	97	221	152	198	221
711	159	33	14	332	245	8	160	104	13	268	64	97	231	158	207	232
712	156	33	13	332	245	8	160	104	12	268	64	98	241	165	216	242
713	152	32	13	333	245	8	160	104	12	268	64	98	251	171	225	252
714	147	31	13	332	246	7	160	104	12	268	65	98	261	178	234	262
715	141	29	12	332	246	7	159	104	11	268	65	99	271	184	243	272
716	136	28	12	331	246	7	158	104	11	267	65	99	281	191	253	282
717	131	27	11	330	247	7	157	103	11	266	65	100	291	197	262	291
718	126	26	11	328	247	6	156	103	10	264	65	100	301	204	271	301
719	122	26	11	326	247	6	155	103	10	262	65	100	311	210	280	310
720	121	25	10	324	247	6	153	103	9	260	65	101	322	217	290	319
721	118	25	10	321	247	6	152	103	9	258	65	101	332	223	299	328
722	116	24	10	318	247	6	150	102	9	255	65	101	342	229	309	337
723	114	24	10	316	247	6	148	102	9	253	64	101	352	236	318	346
724	114	24	10	313	247	5	147	101	9	250	64	101	362	242	328	355
725	115	24	10	310	246	5	145	101	9	248	64	101	372	249	337	364
726	117	25	10	307	246	6	143	100	9	246	63	101	382	255	347	373
727	121	25	10	305	245	6	142	100	9	243	63	101	393	261	356	382
728	126	26	10	302	245	6	141	99	9	241	62	101	403	267	365	391
729	132	28	11	300	244	6	140	99	10	240	62	101	413	274	375	400
730	137	29	11	299	244	6	139	98	10	238	61	100	423	280	384	410
731	141	30	11	298	243	7	138	97	11	238	61	100	433	286	394	419
732	145	30	12	298	242	7	138	97	11	238	61	100	443	292	403	428
733	145	30	12	293	241	7	138	96	11	238	60	99	453	298	412	438
734	142	30	12	293	241	7	138	96	11	238	60	99	463	304	422	447
735	136	28	12	292	240	7	139	95	11	237	60	98	473	310	431	456
736	128	27	11	290	240	7	137	95	10	237	60	94	483	316	440	465
737	121	25	11	298	239	6	138	95	10	238	59	93	493	322	449	474
738	118	25	10	297	239	6	139	94	9	237	59	93	503	323	459	483
739	114	24	10	295	238	6	137	94	9	236	59	97	10	4	0	0

Figure 7.6

```
>>RUN
DISPLAY7

T34C/T28                    VT2/3/6/27                    APR 20, 1976
```

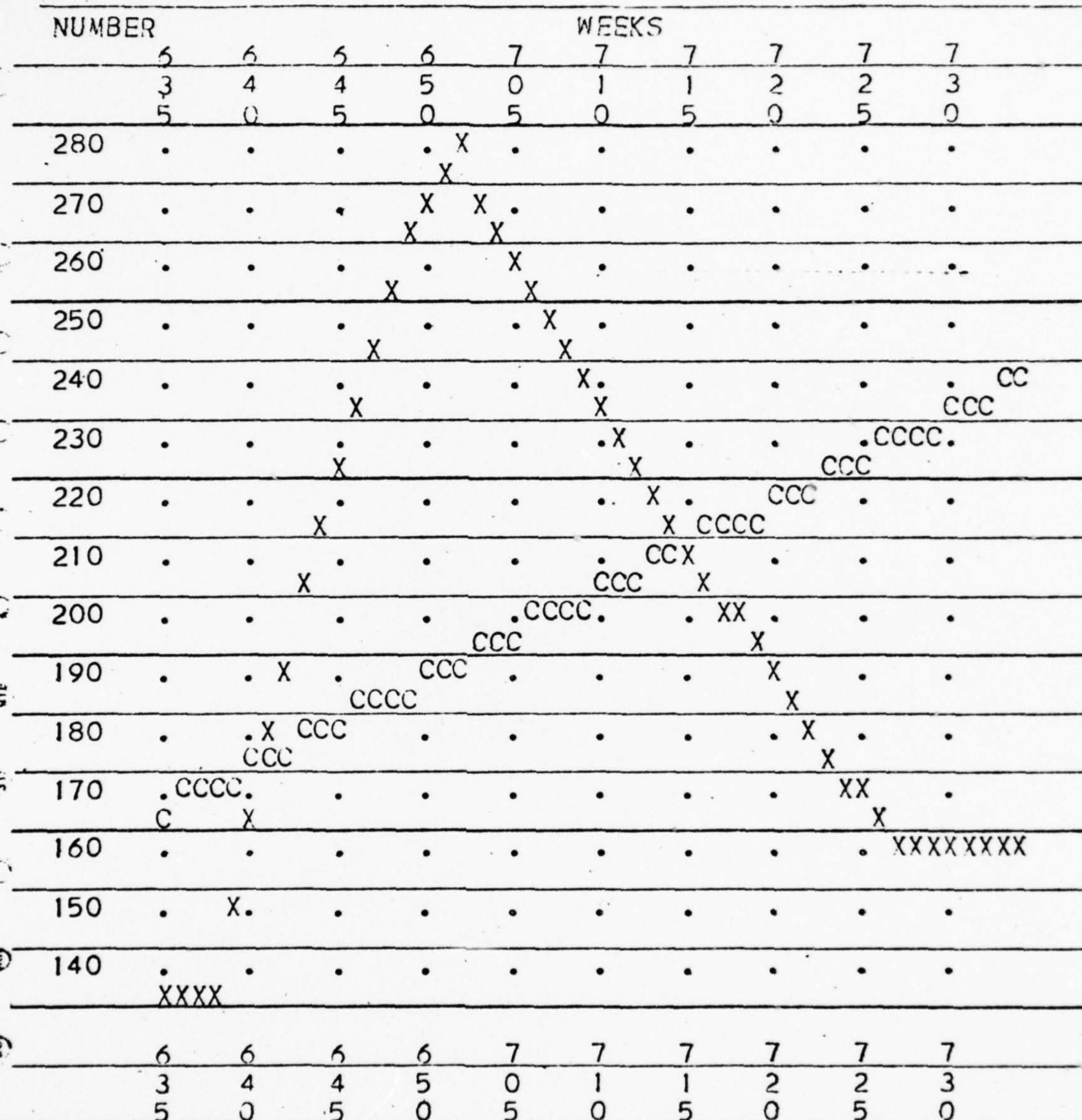


Figure 7.7

Thus, while some of the shortfall is due to the slow drying up of the old UPT pipelines, at least 102 of the shortfall is due to too lean a pipeline.

The final demonstration of the HOWGOZIT concept examined the supply and demand relationship for T28 and T34C aircraft during the transition to NIFTS. Figure 7.7 shows the supply, C , and demand, X , based upon the numbers of aircraft given in the scenario and the student populations determined by the model. Note that from the 41st week of 1976 to the 15th week of 1977, there will be a shortage of aircraft and that by mid 1977 there will be a large excess of capacity. Management has many options to alleviate this crunch. It could pool students at the start of training and accept a reduced PTR. It could load the jet pipeline in advance of the transition. It could attempt to obtain more T28 aircraft and instructors for that short period. Or it could attempt some modification of the syllabus during transition. Obviously, the search for a reasonable alternative would be facilitated with the capabilities of a fully developed HOWGOZIT.

8. Conclusions

On the basis of the demonstration of HOWGOZIT, the following conclusions have been reached. First, HOWGOZIT can track the NIFTS transition. Second, HOWGOZIT could be implemented on a minicomputer or on INFONET, the time-sharing computer service used in the CNATRA Headquarters. Third, some initial capability in HOWGOZIT seems essential to track the training process. Finally, that watchful management with a HOWGOZIT should be in good position to effect substantial economies in the efficient use of training resources.

REFERENCES

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[2] CAVES, WILLIAM E. and W. L. WILKINSON (1977). Dynamic student flow model in a crisis management system. Technical Paper Serial T-362. Program in Logistics, The George Washington University.

[3] GOVAN, G. W. (1974). An Evaluation of the Resources Management System Within the Naval Air Training Command. Institute for Professional Development, Air University.

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APPENDIX A

DATA FILES

Input Files

PTR - This file contains a three dimensional array of planned pilot completions by pipeline, service, and year. This data is obtained from the CNO notice issued annually with modifications as occurring. Currently there are: three pipelines - jet, prop and helo; four services - Navy, Marine Corps, Coast Guard, and Foreign; and two or three years - current and one or two out years.

STUDIN - This file contains a two dimensional array of planned student inputs by source and week. This data is obtained from the CNO notice issued annually with modifications as occurring. Currently there are: five input sources - AOC, AVROC, Officer, Marine Corps, Coast Guard, and Foreign; and 50 input weeks (two weeks over the Christmas-New Year period have no input). Note that service and source are identical for non-Naval personnel. Naval personnel have different routes through Naval Aviation Schools Command depending upon source and the source distinction must be maintained until entry into the primary phase of flight training.

TRAIN - This file contains a three dimensional array of moving averages of variables related to student training. The variables are: student syllabus hours/student flying day (SSH/SFD); student completions/ student syllabus hours (COMP/SSH), student attrition/student completion (ATTR/COMP), and an acceleration factor. Each variable is tabulated by organization and service; currently there are 22 squadrons providing flight training and four services. The acceleration factor is used to project a training rate (SSH/SFD) scaled to the moving average and is a management dictated input. All other data is obtained by regular updates from the Weekly Aviation Statistical Reports.

STUDLOAD - This file contains a three dimensional array of actual student load by organization, service and week. In this file it is necessary to account for all students who have entered the system, therefore it includes as organizations: all pools, in transit states and terminal states (final completions and attritions) as well as the 22 training squadrons. Thus each week's data will be a table of about 50 organizations by four services. Normally 50 weeks of data will be maintained in these files. All data is obtained by regular updates from the Weekly Aviation Statistical Reports.

RESAVAIL - This file contains a three dimensional array of variables related to the projected availability of resources by organization and week. Resources considered are aircraft, instructors, and maintenance personnel for the some 22 squadrons providing flight training. Normally 50 weeks of projected availabilities will be maintained. As a default when a new week is added, the availabilities will equal to those in the immediate prior week. As impending changes to availabilities become known, an update to this file should be made.

RESFACT - This file contains a two dimensional array of moving averages of factors related to the productivity of resources. The variables are: instructor flight hour/student syllabus hour (IFH/SSH), instructor flight hour/instructor flying day (IFH/IFD), aircraft flight hour/student syllabus hour (AFH/SSH), aircraft flight hour/aircraft flying day (AFH/AFD), aircraft flight hour/maintenance man-hour (AFH/MMH) and an efficiency factor. Each variable is tabulated by organization, currently 22 squadrons. The efficiency factor is a coefficient used to scale projected resource utilization to the moving average and is a management dictated input. All other data is obtained by regular updates from the Weekly Aviation Statistical Reports.

WEATHER - This file is a two dimensional array of moving averages of flying days/scheduled days by organization and week. There are 22 squadrons and 50 weeks of data in this file. The source of the data is the regular updates of the Weekly Aviation Statistical Reports.

WINGSPLIT - This file contains a three dimensional array of coefficients reflecting the fractional split of pipeline students between the wings. The data is tabulated by wing, service and week. The data in this file reflects a management determination and is relatively static.

Output Files

STUDFLOW - This file is a two dimensional array of the mean student input, output, and load by organization and service. This data is calculated by PIPEFILL on the assumption of feasibility of the PTR given the beginning student load and planned input schedule. It is recalculated whenever there is a change in the PTR or STUDIN files.

STUDSPLT - This file is a two dimensional array of coefficients reflecting the fractional input required to meet the PTR by pipeline and service. The data is calculated by PIPEFILL under the assumption of feasibility of PTR as stated above. It is recalculated whenever there is a change in the PTR or STUDIN files.

STUDPROG - This file is a three dimensional array of number of weeks ahead/behind schedule by organization and service. The calculations are made weekly by the PROGRESS program and added to the file to form a historical record.

STUDOUT - This file is a three dimensional array of most recent projection of number of students completing by organization, service, and week. The projections are made by the STUDTHRU program whenever there is a change in the PTR or STUDIN files and at other times when it seems desirable.

WORKLOAD - This file is a three dimensional array of the most recent projection of student syllabus hours (SSH), and number of students available for training by organization, service, and week. The projections are made by the STUDTHRU program whenever there is a change in the PTR or STUDIN and at other times when it seems desirable.

APPENDIX B

PROGRAMS

PIPEFILL - For any pipeline phase, given an initial student population, an attrition rate, a mean time to complete, a mean time to attrite, and a required number of completions, this program will calculate the mean flow of students through the phase (completions and attritions). This sizes the mean student load at that phase. The program assumes that the final population should be equal to the mean student load. The input is then calculated as the completions plus attritions plus any difference between final and initial student load. The output of the precessor phase is then set equal to the required input for the following phase.

Given

S = initial student population

a = attrition rate

L_c = mean time to complete

L_A = mean time to attrite

C = required number of completions.

Let

A = number of attrites

$A = C \times a/(1-a)$

F = mean weekly flow

$F = C/50$

M = mean load

$M = (C \times L_c + A \times L_A)/50.$

If the final population is set equal to the mean load, then the input,

$$I = C + A + M - S \ .$$

The input, in turn, becomes the required output of the predecessor phase.

The program assumes one week would be spent in a post-primary pool and one week in either a pre-jet, pre-prop, or pre-helo pool. This serves two purposes. First, it accounts for the approximately two weeks time students spend changing stations following primary training. Secondly, by splitting the period this way, the mean loads in the pools represent the expected weekly completions from primary and the expected weekly inputs to each pipeline. STUDSPLT is then calculated as the ratio of the various pipeline inputs to primary output. For all other pools there is no planned delay and therefore no planned load.

PIPEFILL calculations are executed by services recognizing that all students except Navy AOC enter through EI. Therefore all deficiencies in non-Navy input appear on the EI side. Since the Navy input is split it must be handled differently. As a convention, it is assumed the Navy flow through EI is fixed and any deficiency must be made up in the AOC input. Therefore the program calculates the output of EI using input from STUDIN and subtracts this from the input to primary to give the required output from AOC. The calculation of input to AOC then proceeds as with other phases.

PIPEFILL permits viewing the type 1 display for either a single service or the total aggregation.

PROGRESS - The state of training is determined by a combination of the number of completions and the number of students under training. If a phase were exactly on schedule, it would have made the required number of completions and had the required number of students on board under training. As discussed elsewhere in the text, a student in training is considered halfway to completion. PROGRESS applies a correction to the number of completions by one half the difference between the actual student load and the mean load. The corrected completions are divided by the mean flow to determine the number of equivalent weeks completed. The difference between the equivalent weeks and the actual weeks is the status in weeks

ahead or behind schedule. A weather correction may be applied if considered worthwhile. The weather correction is due to a season variation. In the case of primary training where weather is most constraining, the correction ranges from plus 1.0 week in November to minus .3 week in late spring. A graph of the seasonal adjustment for primary is shown in Appendix E.

Given

C_k = cumulative completions through the kth week from STUDLOAD

S_k = student population for the kth week from STUDLOAD

F = mean weekly flow from STUDFLOW

M = mean weekly load from STUDFLOW

W = week number from user

WX_k = weather correction, kth week, from WEATHER.

Let

P_k = state of training at the kth week

$$P_k = (C_k+(S_k-M)/2)/F - W - WX_k \; .$$

The results of this calculation are tabulated in STUDPROG and displayed in type 2 or 3 displays.

STUDTHRU - This program assumes students flow through the training network as a Markov process. A transition matrix, T , based on transitions occurring at regular weekly intervals, can be constructed where t_{ij} is the fraction of those in state i remaining at state i after a single transition.

$$t_{ii} = 1 - \Sigma\, t_{ij} \qquad j \neq i$$

$$t_{ii} = 1/L_i$$

where L_i is the mean time in state i .

$$t_{ij} = f_{ij}/L_i$$

where f_{ij} is the fraction of those leaving state i which enter state j .

If $S(t)$ is a vector of student population S at each state, $S_1, S_2 \ldots S_N$, at time t, then at time $T+1$

$$S(t+1) = S(t) \times T .$$

Where there are additional inputs, $I(t)$, to the system from outside sources during the transition from t to $T+1$, then

$$S(t+1) = (S(t) \times T) + I(t)$$

where $I(t)$ is a vector of inputs to state i from outside sources.

For STUDTHRU the transition matrix is quite sparse. From any state there are only a few successor states. If i is a training state (except primary), j is either the next phase in the pipeline or an attrite. If i is the primary phase, j is the post primary pool or an attrite. If i is a pool (except the post primary pool), j is only the next pipeline phase. (No attrition from pools.) If i is the post primary pool, j are the several pre-pipeline pools. If i is terminal state (completion or attrition) there are, of course, no successor states.

Mean time in state i, L_i, is calculated as follows:

L_{c_i} = mean weeks to complete state i

L_{A_i} = mean weeks to attrite from state i

a_i = attrition fraction

$$L_i = a_i \times L_{a_i} + (1-a_i)\, L_{c_i} .$$

Unfortunately, the Weekly Statistical Reports do not show the time to attrite. However, there is a widely held assumption that attrition takes place about halfway through the course. If this is so, then

$$L_i = (1-a_i/2)\, L_{c_i}$$

$$L_{c_i} = \begin{cases} 1 \\ \infty \end{cases} \text{for } i = \begin{cases} \text{a pool} \\ \text{a terminal state} \end{cases} .$$

Then the elements of T are

$$t_{ii} = \begin{cases} 0 \\ 1 - 1/L_i \\ 1 \end{cases} \quad i = \begin{cases} \text{a pool} \\ \text{a training state} \\ \text{a terminal state} \end{cases} .$$

$$t_{ij} = \begin{cases} f_{ij} & i = \text{post primary pool} \quad j = \text{prepipeline pool} \\ 1 & i = \text{other pools} \quad j = \text{successor training state} \\ 1 - a_i/L_i & i = \text{training state} \quad j = \text{successor training state} \\ a_i/L_i & i = \text{training state} \quad j = \text{attrition state} \\ 0 & \text{elsewhere} \end{cases}$$

The data for the current student load is read from the STUDLOAD file. The data for the transition matrix is read from the STUDSPLT and TRAIN files. The output of STUDTHRU is; first, the cumulative projected completions by organization, service and week (STUDOUT file) and second, the projected onboard student population by organization, service and week (WORKLOAD FILE).

STUDANAL - This program generates DISPLAY 4 (similar to Figure 7.1) showing the projected state of the system at the end of the fiscal year. Completions from the final phases are shown as the required PTR $\pm$ projected differences. There are otherwise no computational actions in this program.

STUDANAL also generates DISPLAY 5 (similar to Figure 7.2) showing the cumulative projected completions by organization and week. If desired, the user may specify the service to be shown in either of the foregoing displays, otherwise the composite total will be shown.

STUDANAL reads data from the STUDOUT, PTR and STUDLOAD files.

WORKANAL - This program generates DISPLAY 6 (similar to Figure 7.7) for instructors, aircraft and maintenance personnel. The demand for resources is the product of the expected student load and the ratio of resource required per student. The latter ratios for aircraft and instructors to students are shown in the right hand and second from right columns of Figure 6.1 These ratios are in turn the product of three other ratios which are maintained as moving averages in the TRAIN and RESFACT file.

For the instructor/student ratio

$$I/S = ((IFH/IFD) \times (SSH/IFH))/(SSH/SFD) .$$

The supply of resources is read from the RESAVAIL FILE.

APPENDIX C

DISPLAYS

DISPLAY 1 - Similar to Figure 7.1 except that outputs are the required PTR outputs. End populations and attrition are calculated by PIPEFILL. Inputs to AOC and EI are shown as the planned input $\pm$ any deficiency as calculated by PIPEFILL. Status is omitted from display. Title indicates year and service displayed.

DISPLAY 2 - Shown in Figure 7.1. Title indicating date and service displayed should be added.

DISPLAY 3 - Similar to Figure 7.1 except that the jet pipeline is displayed by wings.

DISPLAY 4 - Similar to Figure 7.1 except that the inputs are the planned inputs. End populations, attrition, and outputs are calculated by STUDTHRU. Outputs from final phases are shown as the PTR $\pm$ any deficiency as calculated by STUDTHRU. Status is omitted from display. Title indicates year and service displayed.

DISPLAY 5 - Similar to Figure 7.2 Title indicating date and service displayed should be added.

DISPLAY 6 - See Figure 7.7.

APPENDIX D

UPDATES

UPDATES have a twofold function. They modify data to HOWGOZIT and, as a secondary action, they cause the execution of programs which operate on this modified data. UPDATES are in themselves programs and are the essential feedback mechanism which leads to improved projections.

NUPTR - Annually and on occasion when a new PTR is promulgated, the PTR file is modified and the student route through HOWGOZIT is executed for the first order test of feasibility of the new PTR. (The user may try a PTR of his own selection to observe resulting changes in the system.)

NUSTUDIN - This update is executed annually for each annual CNO promulgation of planned student input. The new schedule is added to STUDIN and the student throughput is analyzed in detail by execution of the STUDTHRU, STUDANAL and WORKANAL programs. On the infrequent occasion of a midyear change of the input schedule, NUSTUDIN will reexecute the analysis procedure. (As with PTR, the user is free to experiment with an input schedule of his own selection in order to observe resulting changesin the system.)

NUSPLT - The split of students between wings in the jet pipeline and the prop pipeline are an internal NATRACOM action. The split must account for differences in base capacities plus special requirements, say for Master's degree students or certain foreign students. NUSPLT updates the WINGSPLT file but does not cause execution of other programs.

NUWASR - Until recently this update would have been executed weekly with each new Weekly Aviation Statistical Report. Now the period has been changed to biweekly. NUWASR computes various moving averages which are maintained in the TRAIN, RESFACT and WEATHER files. The technique of exponential smoothing is used to reduce the amount of data stored. If $x(t)$ is the observation of x between $t - 1$ and t and $\bar{x}(t)$ is the moving average at time t,

$$\bar{x}(t) = k\ x(t) + (1-k)\ x(t-1)$$

where k is the smoothing constant. Note if $k = 1$, then the moving average is only the most recent observation. As k becomes smaller, the memory of prior observations becomes larger.

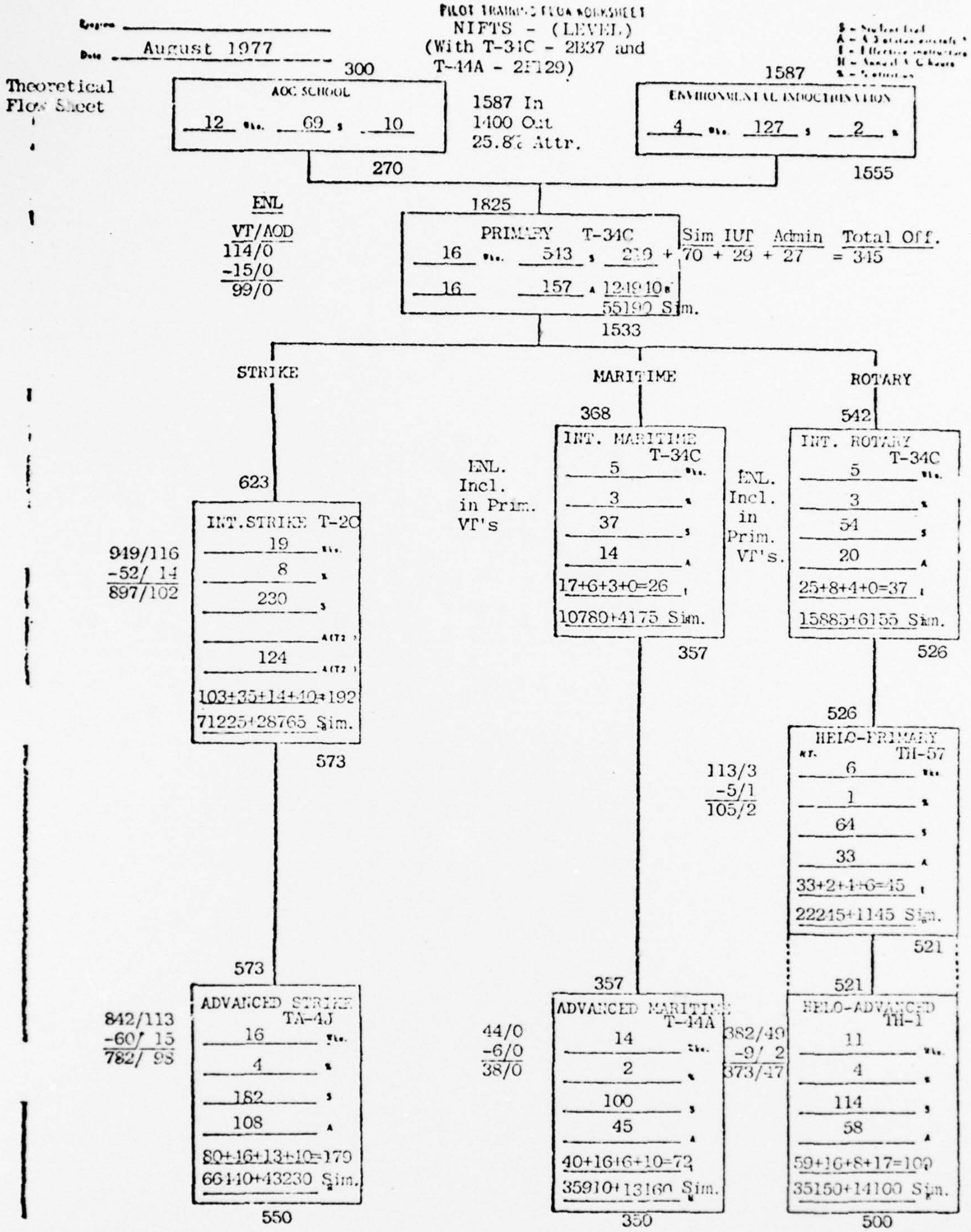
For the moving averages in the TRAIN and RESFACT files, a value of $k = 1/25$ for biweekly data is used. In the WEATHER file there are moving averages of flying days/scheduled day by week of the year since this relationship is so seasonably dependent. NUWASR updates the period of concern using $k = 1/5$ since the current data has been taken as a five year average.

NUWASR then causes the PROGRESS program to be executed in order to display the current state of progress toward the required PTR.

NURESAVL - This update is provided to permit planned changes in resource availability. NURESAVL modifies the appropriate data in the RESAVAIL file and executes WORKANAL for the resource changed. (The user may test various allocations of resources using NURESAVL.)

NUEFF - This update is provided to permit the change in the efficiency factor in RESFACT. The efficiency factor biases the historical resource productivity factors in order for management to set production goals relative to past performance. NUEFF causes WORKANAL to be executed for the organization and resources concerned. (The user may experiment with various local changes in order to observe the overall effect on the system.)

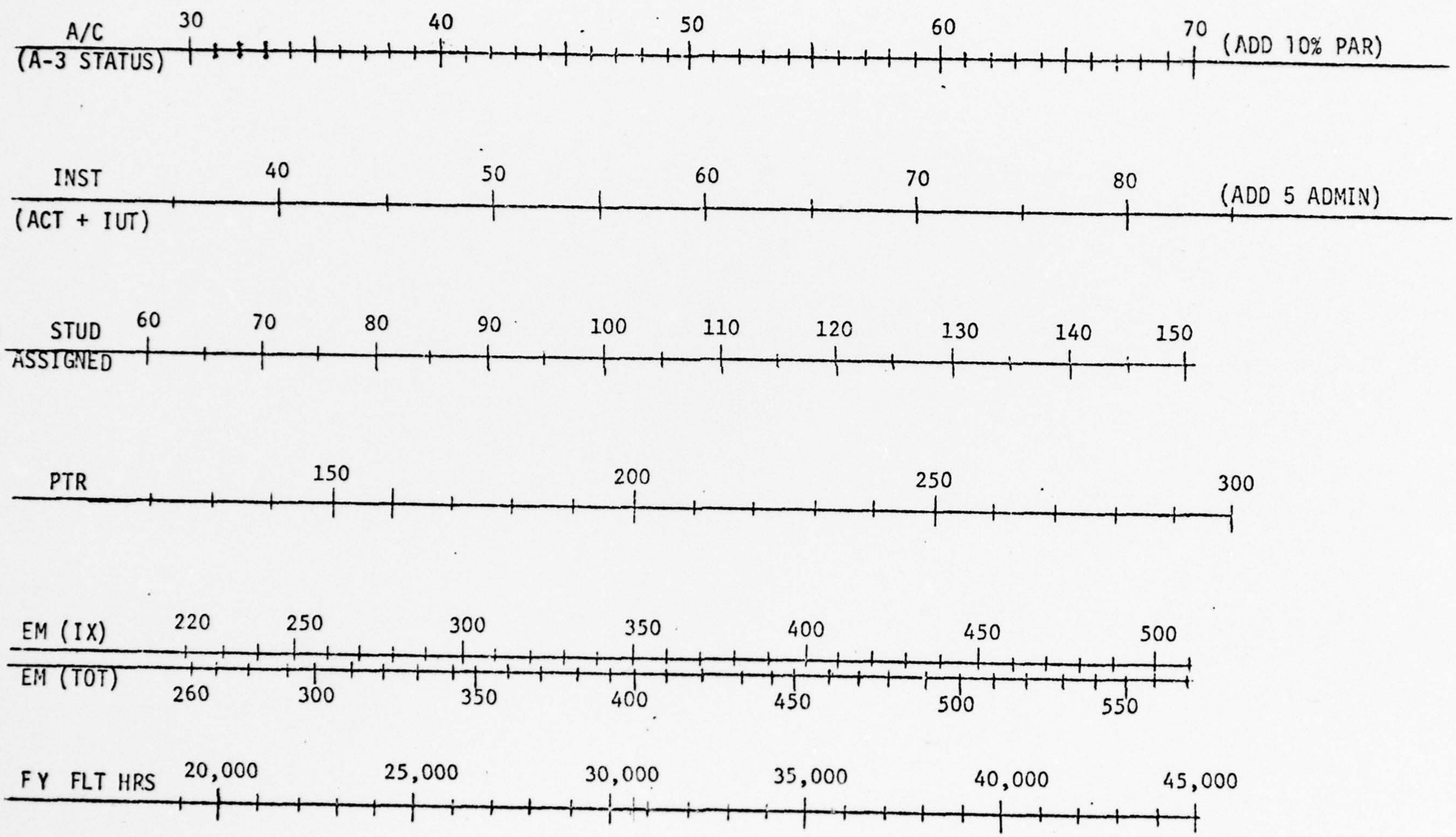
NURATE - This update is provided to permit changes in the student instruction rate. NURATE functions similarly to NUEFF.



FY	NAVY	MARINE	OTHER	Total
Strike				550
Maritime				350
Rotary				500
Total				1400

FY	NAVY	MARINE	OTHER	Total
Jet				
Prop				
Helo				
Total				

T-2C SQDN RATIOS



APPENDIX F

Geo Washington Univ Study Group

CNATRA 1542/36 (REV. 8-72)

WEEKLY AVIATION STATISTICAL REPORT

WEEK ENDING 21 MARCH 1976 '011'

CNATRA Report 1542-7

SQUADRON	STUDENTS: INPUT (1)	AVERAGE ASSIGNED (2)	AVERAGE IN FLT. STATUS (3)	ON BOARD END N/M/CG/FOR (4)	WEEKLY COMPLETIONS: NAVY (5)	MARINE (6)	CG/FOR (7)	TOTAL (8)	AVERAGE WEEKS TO COMPLETE (9)	AVERAGE HOURS TO COMPLETE (10)	CUMULATIVE COMPLETIONS: NAVY (11)	MARINE (12)	CG/FOR (13)	TOTAL (14)	AVERAGE WEEKS TO COMPLETE (15)	AVERAGE HOURS TO COMPLETE (16)	ATTRITIONS: WEEKLY N/M/CG/FOR (17)	CUMULATIVE N/M/CG/FOR (18)	WEATHER: SCHED DAYS (19)	% (20)	FLY DAYS (21)
AOCS (PILOT)	2/0 0/0	85		85/0/0/0	1			1	13.00		181			181	11.37			26/0/0/0			
A. I. (PILOT)	11/17 0/0	138		68/55/5/10	11	12	1/3	27	4.22		568	271	37/72	948	3.52		0/0/0/1	9/3/0/7			
PRIMARY VT1	5/8 1/0	96	85	46/30/8/5	6	3	2/	11	5.14	26.0	337	118	10/26	491	5.37	28.3	0/1/0/0	26/18/1/3	5.0	80.6	4.03
VT5	0/4 0/3	103	94	59/28/8/8	5			5	5.57	25.8	321	103	9/25	458	5.25	28.8	1/0/0/1	26/27/1/5	5.0	72.2	3.61
BASIC JET VT4		29	25	15/2/0/12	5	2		7	27.97	121.4	30	6		36	34.95	123.2		5/2/0/0	5.0	84.4	4.22
VT4 (MSP)				XXXXXXXXXX XXXXXXXXXX							(3)	(3)		(6)	(46.66)	(129.2)					
VT4 (NON MSP)				XXXXXXXXXX XXXXXXXXXX	(5)	(2)		(7)	(27.97)	(121.4)	(27)	(3)		(30)	(32.59)	(121.9)					
VT9		44	31	28/9/2¢/0	3	1/3¢		4/3¢	24.72	106.6	22	13/9¢		35/9¢	22.56	105.8		3/2/0/0	5.0	75.0	3.75
VT19		40	34	29/9/2¢/0	1	/2¢		1/2¢	20.86	106.2	22	9/10¢	/9	40/10¢	22.49	104.6		2/1/0/1	5.0	74.6	3.73
VT23	6/2 0/0	113	60	87/25/0/0		1		1	25.43	128.5	69	47		116	27.62	113.9	1/0/0/0	7/8/0/0	5.1	82.0	4.18
VT26	5/0 0/0	90	83	69/17/0/0	7	1		8	22.06	103.5	98	27		125	22.13	103.7		11/9/0/0	5.0	76.2	3.81
SUB TOTAL	11/2 0/0	316	233	228/62/4¢/12	16	5/5¢		21/5¢	24.64	111.4	241	102/ 19¢	/9	352/ 19¢	25.41	109.5	1/0/0/0	28/22/0/1	5.0	78.8	3.94
ADVANCED JET VT4		25	25	21/4/0/0	3	2		5	29.08	128.4	22	22		44	32.95	127.0	1/0/0/0	3/1/0/0	5.0	83.2	4.16
VT4 (MSP)				XXXXXXXXXX XXXXXXXXXX	(1)			(1)	(29.28)	(128.2)	(11)	(6)		(17)	(33.21)	(122.7)					
VT4 (NON MSP)				XXXXXXXXXX XXXXXXXXXX	(2)	(2)		(4)	(29.03)	(128.4)	(11)	(16)		(27)	(32.79)	(129.7)					
VT7		48	37	22/15/8¢/2			/1	1			48	10/14¢	/6	64/14¢	19.44	120.3		7/5/0/1	5.0	76.6	3.83
VT21		38	30	21/17/0/0							38	12		50	20.12	114.8			5.0	87.0	4.35
VT22		34	27	18/16/0/0							35	14		49	20.21	121.0		4/2/0/0	5.0	89.6	4.48
VT24	4/1 0/0	40	35	30/6/0/3	1	1		2	21.57	115.6	36	16	/5	57	21.12	120.3		3/3/0/1	5.0	86.3	4.32
VT25	4/1 0/0	46	40	32/9/0/3	3	1		4	23.57	119.5	35	13	/5	53	20.66	119.3		4/2/0/1	5.0	87.6	4.38
SUB TOTAL	8/2 0/0	231	194	144/67/8¢/8	7	4	/1	12	25.71	122.8	214	87/14¢	/16	317/ 14¢	22.14	120.3	1/0/0/0	21/13/0/3	5.0	85.0	4.25

¢ SPECIAL MARINES

(OVER)

PAGE 1 OF 3

WEEK ENDING 21 MARCH 1976

SQUADRON	TOTAL ENLISTED PERSONNEL ASSIGNED IX/OTHER	IUT'S	AVIATORS IN ADMIN. BILLETS	NON-AVIATORS IN ADMIN BILLETS	OTHER NON-AVIATORS	NPEA	MARINE AVIATORS
	(22)	(23)	(24)	(25)	(26)	(27)	(28)
VT1	96/17	2	5		4	13	10
VT5	88/20	2	5		5	17	9
VT4B	221/26	4	6	1	8	11	7
VT4A		4	3			3	4
VT7	229/20	5	5	4	5	8	17
VT9	104/18	5	5	1	3	6	5
VT19	106/20	2	5		7	6	9
VT21	248/19	5	5		6	4	11
VT22	154/14	5	5		6	5	12
VT23	280/39	9	5		6	19	10
VT24	164/20	6	5		5	6	11
VT25	161/29	5	5		5	7	11
VT26	257/42	11	5		9	18	17
SUB TOTAL	2108/284	65	64	6	69	123	133

REMARKS

WEEKLY STUDENT ATTRITION RECORD,

NAME	CATEGORY	GROUP	REASON	STAGE	DATE
BYRD, W. J.	USN ROTC FIP	VT23(18)	LOM	FAM/RI	3-18-76
ANDERSON, W. L.	AOC	VT4(14)	FLIGHT		3-16-76
LANEY, D. M.	USMCR	VT1(13)	NPQ	PS	3-17-76
GHOZATI, M. H.	IRANIAN	VT5(17)	FLIGHT	PA	3-15-76
HOPPER, R. W.	OCS	VT5(3)	FLIGHT	PS	3-19-76
AL-SANAFI, A. H.	KUWAITI	AI(3)	ACADEMIC		3-16-76

POOL/AWAITING TRAINING STUDENTS

AWAITING PRIMARY 7/0/0/0

AWAITING BASIC

NAVAVSCOLSCOM	5/2/0/0
TRAWING ONE	4/1/0/0
TRAWING TWO	8/1/0/0
TRAWING THREE	9/2/0/0
TRAWING SIX	1/0/0/0

AWAITING ADVANCED

TRAWING ONE	4/1/6c/0
TRAWING TWO	3/1/0/0
TRAWING THREE	8/1/0/0
TRAWING SIX	6/2/0/0

TOTAL BASIC 27/6/0/0 TOTAL PRIMARY 7/0/0/0 TOTAL ADVANCED 21/5/6c/0

GRAND TOTAL 55/11/6c/0

CNATRA 1543/86 (8-72) (BACK)

CNATRA 1542/26 (REV. 8-72) CNATRA Report 1542-7

WEEKLY AVIATION STATISTICAL REPORT

WEEK ENDING 21 MARCH 1976

SQUADRON		STUDENTS		INSTRUCTORS							AIRCRAFT							NON-PIPELINE STUDENTS	
		SYLLABUS HOURS					STUDENT INSTR. HOURS		TOTAL AVIATOR HOURS					SYLLABUS A/C HOURS		TOTAL A/C HOURS		REF OTHER	
		WEEKLY	CUMULATIVE	AVERAGE ASSIGNED	AVERAGE IN FLT. STATUS	% IN FLT. STATUS	WEEKLY	CUMULATIVE	WEEKLY	CUMULATIVE	AVERAGE ASSIGNED	AVERAGE IN COMM.	% IN COMM.	WEEKLY	CUMULATIVE	WEEKLY	CUMULATIVE	INPUT	ON BOARD END
		(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)
PRIMARY																			
VT1	T34	466	14965	45	40	89	411	12489	469	17257	43	37	86	466	14965	536	18495		
VT5	T34	411	14982	35	31	89	325	12164	415	16772	40	38	95	411	14982	465	17901		
BASIC JET																			
VT4	T2C	131	3620	23	20	87	119	3173	137	5575	21	18	86	151	3970	163	6331		
VT9	T2C	106	4674	19	15	79	63	3431	128	6006	25	15	60	117	4975	162	6369		3
VT9	PRE S-3		931					931		931					931		931		
VT19	T2C	164	5715	24	19	79	139	5285	254	8549	22	13	59	172	6330	231	7985		1
VT19	PRE S-3	17	[illegible] 969				17	10610 969	17	16455 969				17	13305 969	17	16254 969		
VT23	T2C	361	13456	45	43	96	326	11340	448	17451	54	34	63	390	14839	448	18140		
VT26	T2C	469	14291	53	46	87	398	11535	591	18881	56	35	62	505	15255	599	18984		
VT26	PRE S-3		101					101		101					101		101		
SUB TOTAL		1248	43757	164	143	87	1062	36765	1575	58463	178	115	65	1352	47370	1620	59810		
ADVANCED JET																			
VT4	TA4J	140	5713	25	21	84	108	4872	150	6319	21	14	67	165	6769	200	8032		
VT7	TA4J	172	9502	47	34	72	211	8832	248	12699	40	21	52	253	11679	274	13824		
VT21	TA4J	226	7430	36	25	69	194	5623	238	8956	38	19	50	276	8735	305	10374		
VT22	TA4J	204	6831	36	27	75	183	5814	276	8547	31	21	68	259	8353	308	10321		/1
VT24	TA4J	282	7638	28	28	100	230	6333	260	9672	30	20	67	363	9539	368	11211		
VT25	TA4J	245	7805	34	27	79	208	6818	266	9594	31	18	58	307	9798	332	11373		
SUB TOTAL		1269	44919	206	162	79	1134	38292	1438	55787	191	113	59	1623	54873	1787	65135		

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CNATRA 1542/06 (REV. 8-72)

WEEKLY AVIATION STATISTICAL REPORT

WEEK ENDING 21 MARCH 1976

CNATRA Report 1542.7

SQUADRON	STUDENTS																		WEATHER		
	INPUT	AVERAGE ASSIGNED	AVERAGE IN FLT. STATUS	ON BOARD END N/M/CG/FOR	WEEKLY COMPLETIONS				AVERAGE WEEKS TO COMPLETE	AVERAGE HOURS TO COMPLETE	CUMULATIVE COMPLETIONS				AVERAGE WEEKS TO COMPLETE	AVERAGE HOURS TO COMPLETE	ATTRITIONS		SCHED. DAYS	%	FLY DAYS
					NAVY	MARINE	CG / FOR	TOTAL			NAVY	MARINE	CG / FOR	TOTAL			WEEKLY N/M/CG/FOR	CUMULATIVE N/M/CG/FOR			
	(1)	* (2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
BASIC PROP VT3	1/0 0/0	84	76	83/0/0/0	2			2	22.86	97.7	152		1/5	158	19.77	100.6		39/0/0/0	5.0	79.2	3.96
VT27	2/0 1/0	71	60	67/0/1/2	2		1/	3	25.14	102.1	169		7/9	185	20.90	92.3	1*/0/0/0	20/0/2/0	5.5	64.2	3.53
SUB TOTAL	3/0 1/0	155	136	150/0/1/2	4		1/	5	24.00	99.9	321		8/14	343	20.36	96.2	1/0/0/0	59/0/2/0	5.2	72.7	3.78
ADVANCED PROP VT28	2/0 0/0	79	61	68/0/0/11	1			1	20.57	81.5	129		3/1	133	15.80	84.3		8/0/0/0	5.5	94.8	5.21
VT31	2/0 0/0	81	61	73/0/1/7	1			1	16.43	91.5	135		4/6	145	15.01	87.2		2/0/0/0	5.5	99.4	5.47
SUB TOTAL	4/0 0/0	160	122	141/0/1/18	2			2	18.50	86.5	264		7/7	278	15.40	85.8		10/0/0/0	5.5	97.1	5.34
BASIC PROP-HELO VT2	1/1 1/0	108	93	51/37/2/17	2	1		3	20.14	92.3	75	73	11/19	178	21.31	102.0	2/1/0/0	18/13/0/4	5.0	72.8	3.64
VT6	1/0 0/2	114	100	53/43/2/17	1			1	28.57	113.2	63	67	10/17	157	22.84	99.0		7/14/0/5	5.0	70.6	3.53
SUB TOTAL	2/1 1/2	222	193	104/80/4/34	3	1		4	22.25	97.5	138	140	21/36	335	22.03	100.6	2/1/0/0	25/27/0/9	5.0	71.6	3.58
PRIMARY HELO HT8	3/2 1/3	64	59	7/37/5/9	2	4	1/	7	6.71	37.0	152	138	19/23	332	6.38	36.6		1/1/0/0	5.0	74.2	3.71
ADVANCED HELO HT18	3/2 0/1	91	79	35/45/1/6	1	3		4	8.57	61.7	182	133	18/18	351	10.17	65.4		10/7/0/0	5.0	76.6	3.83
TOTAL STUDENTS JET/PROP/HELO	3/17 0/0			1067/416@ 33/112	10	7	/1	18			660	220/ 14¢	25/41	946/ 14¢			6/2/0/2	241/118/4/28			
POOL/AWAITING TRAINING STUDENTS				131/28# 6/2																	
GRAND TOTAL STUDENTS				1198/444% 39/114																	

* ATTRITED FROM THE POOL
@ INCLUDES 12 SPECIAL MARINES
\# INCLUDES 6 SPECIAL MARINES
% INCLUDES 18 SPECIAL MARINES
¢ SPECIAL MARINE

(OVER)

#1

SQUADRON	TOTAL ENLISTED PERSONNEL ASSIGNED IX/OTHER (22)	NIT'S (23)	AVIATORS IN ADMIN. BILLETS (24)	NON-AVIATORS IN ADMIN. BILLETS (25)	OTHER NON-AVIATORS (26)	NFEA (27)	MARINE AVIATORS (28)
VT3	112/15	13	6		3	12	4
VT27	113/15	17	5		5	19	
VT28	205/36	11	5	5	14		
VT31	211/24	10	5		5	13	
VT2	166/24	16	6		3	24	24
VT6	151/21	10	5	1	2	24	25
HT8	79/12		8		1	3	15
HT18	353/36	3	8	1	6		36
SUB TOTAL	1390/183	80	48	7	30	109	104

REMARKS

WEEK ENDING 21 MARCH 1976

WEEKLY STUDENT ATTRITION RECORD

NAME	CATEGORY	GROUP	REASON	STAGE	DATE
FAJER, D. J.	AOC	VT2(5)	DOR	BASIC	3-15-76
HAMEL, D. A.	USNA	VT2(7)	DOR	BASIC	3-15-76
PEACHY, J. G.	USMCR	VT2(25	NOM	BASIC	3-19-76
LAMPTON, D. J.	AVROC	VT27(7)	NPQ	FAM	3-15-76

POOL/AWAITING TRAINING STUDENTS

AWAITING BASIC

TRAWING FOUR		39/0/0/0
TRAWING FIVE	(VT2/6)	12/7/5/2
	(VT3)	15/0/0/0
	(HT8)	3/0/0/0

TOTAL BASIC 69/7/5/2

AWAITING ADVANCED

TRAWING FOUR	5/0/0/0
TRAWING FIVE (HT18)	2/4/1/0

TOTAL ADVANCED 7/4/1/0

GRAND TOTAL 76/11/6/2

CNATRA 1542/36 (8-72) (BACK)

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CNATRA 1542/36 (REV. 8-72)

WEEKLY AVIATION STATISTICAL REPORT

WEEK ENDING 21 MARCH 1976

CNATRA Report 1542-7

SQUADRON		STUDENTS — SYLLABUS HOURS — WEEKLY (29)	STUDENTS — SYLLABUS HOURS — CUMULATIVE (30)	INSTRUCTORS — AVERAGE ASSIGNED (31)	INSTRUCTORS — AVERAGE IN FLT STATUS (32)	INSTRUCTORS — % IN FLT STATUS (33)	INSTRUCTORS — STUDENT INSTR HOURS — WEEKLY (34)	INSTRUCTORS — STUDENT INSTR HOURS — CUMULATIVE (35)	INSTRUCTORS — TOTAL AVIATOR HOURS — WEEKLY (36)	INSTRUCTORS — TOTAL AVIATOR HOURS — CUMULATIVE (37)	AIRCRAFT — AVERAGE ASSIGNED (38)	AIRCRAFT — AVERAGE IN COMM (39)	AIRCRAFT — % IN COMM (40)	AIRCRAFT — SYLLABUS A/C HOURS — WEEKLY (41)	AIRCRAFT — SYLLABUS A/C HOURS — CUMULATIVE (42)	AIRCRAFT — TOTAL A/C HOURS — WEEKLY (43)	AIRCRAFT — TOTAL A/C HOURS — CUMULATIVE (44)	NON PIPELINE STUDENTS — REP OTHER — INPUT (45)	NON PIPELINE STUDENTS — REP OTHER — ON BOARD END (46)
BASIC PROP																			
VT3	T28	370	14808	43	38	88	321	13366	429	17143	37	18	49	384	14990	442	17134		
VT27	T28	290	16487	42	35	83	271	15449	345	18238	34	26	76	297	16840	335	18410		
SUB TOTAL		660	31295	85	73	86	592	28815	774	35381	71	44	62	681	31830	777	35544		
ADVANCED PROP																			
VT28	TS2A US2B	430	12887	44	39	89	394	11687	480	15510	32 2	23 2	72 100	370 42	11585 722	399 56	13414 943		/1
VT31	TS2A US2B	441	14912	50	44	88	388	13187	444	16072	34 2	15 1	44 50	387 28	12969 1083	410 33	14238 1343		
SUB TOTAL		871	27799	94	83	88	782	24874	924	31582	66 4	38 3	58 75	757 70	24554 1805	809 89	27652 2286		
BASIC PROP-HELO																			
VT2	T28	423	16775	54	46	85	368	14804	510	19942	48	27	56	427	17097	507	20279		
VT6	T28	380	15042	63	54	86	361	13854	506	19084	46	18	39	393	15562	477	18709		
SUB TOTAL		803	31817	117	100	85	729	28658	1016	39026	94	45	48	820	32659	984	38988		
PRIMARY HELO																			
HT8	TH57	315	12239	41	35	85	280	10699	403	13986	36	30	83	315	12241	386	14338		
ADVANCED HELO																			
HT18	TH1	536	24282	91	80	88	536	24282	722	32670	72	29	40	536	24282	629	28767		3
MIDN CORPC	T34																1346		
TOTAL HOURS JET/PROP/HELO		6579	246055				5851	217038	7736	300924				7031	259561	8082	310262		

PAGE 3 OF 3

CNATRA 1542/36 (REV 8-72)

WEEKLY AVIA..ON STATISTICAL REPORT

WEEK ENDING 21 MARCH 1976

CNATRA Report 1542-7

SQUADRON	STUDENTS: INPUT (1)	AVERAGE ASSIGNED (2)	AVERAGE IN FLT STATUS (3)	ON BOARD END N M CG FOR (4)	WEEKLY COMPLETIONS: NAVY (5)	MARINE (6)	CG / FOR (7)	TOTAL (8)	AVERAGE WEEKS TO COMPLETE (9)	AVERAGE HOURS TO COMPLETE (10)	CUMULATIVE COMPLETIONS: NAVY (11)	MARINE (12)	CG / FOR (13)	TOTAL (14)	AVERAGE WEEKS TO COMPLETE (15)	AVERAGE HOURS TO COMPLETE (16)	ATTRITIONS: WEEKLY N M CG FOR (17)	CUMULATIVE N M CG FOR (18)	WEATHER: SCHED DAYS (19)	% (20)	FLY DAYS (21)
AOCS (NFO)	12/0 0/0	63		63/0/0/0							170			170	11.46		2/0/0/0	61/0/0/0			
A. I. (NFO)	3/3 0/0	64		20/36/0/8	5	7		12	4.91		217	137	/20	374	3.79			8/11/0/0			
BASIC NFO VT10	21/9 0/0	536	219	386/121/0/28							337	96	/14	447	32.26	44.2	1/0/0/0	71/25/0/0	5.0	91.8	4.59
VT10 HUMRRO											(5)			(5)	18.80	29.9					
ADVANCED NAV NFO VT29		48	9	44/0/0/0	7			7	13.29	62.2	141		/5	146	10.65	61.5		2/0/0/0	6.0	89.6	5.38
ATDS		6		6/0/0/0							12			12							
ADVANCED NFO VT86 RIO	9/2 0/3	53	25	26/27/0/3	1			1	15.29	65.6	42	22	/12	76	13.66	63.4	0/1/0/0	15/16/0/0	5.0	73.4	3.67
AJN	10/3 0/0	36	24	26/9/0/0	2			2	6.43	33.9	95	36		131	7.21	37.0	1/0/0/0	28/5/0/0	5.0	74.0	3.70
TOTAL ADVANCED STUDENTS	19/5 0/3			102/36/0/3	10			10			290	58	/17	365			1/1/0/0	45/21/0/0			
POOL/AWAITING TRAINING STUDENTS				60/31/0/0																	
GRAND TOTAL	15/3 0/0			531/224/0/39																	
PG VT29																			4.0	100	4.00
COAST GUARD		4	4	0/0/4/0									4/	4	8.75	56.7					
JTTU		7	7	6/0/0/0	2			2	14.57	59.2	23			23	13.04	48.6			2.8	94.6	2.65

(OVER)

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WEEK ENDING 21 MARCH 1976

SQUADRON	TOTAL ENLISTED PERSONNEL ASSIGNED IX OTHER (22)	IUT'S (23)	AVIATORS IN ADMIN BILLETS (24)	NON-AVIATORS IN ADMIN BILLETS (25)	OTHER NON-AVIATORS (26)	NFEA (27)	MARINE AVIATORS (28)
VT10	190/24	5/3	6/10	4	1	22	9/4
VT29	71/8	4	/4	1	/4	1/4	
VT86 RIO	160/32	3/7			1	4	4/4
AJN		1/2				1	3/3
SUB TOTAL	421/64	13/12	6/14	5	2/4	28/4	16/11

REMARKS

WEEKLY STUDENT ATTRITION RECORD

NAME	CATEGORY	GROUP	REASON	STAGE	DATE
HOUCK, I. C.	AVROC	VT10(5)	ACADEMIC		3-19-76
BALIJA, D. J.	USMCR	VT86*	PRAC WORK FAIL	RIO	3-15-76
WATKINS, G. N.	NESEP	VT86	LOM	AJN	3-16-76
SMITH, R.	NFOC	AOCS(5)	NAM		3-18-76
TIARSMITH, J.	NFOC	AOCS(11)	CH TO SNA		3-18-76

* ATTRITED FROM THE POOL

POOL/AWAITING TRAINING STUDENTS

AWAITING BASIC

TRAWING SIX 38/31/0/0

TOTAL BASIC 38/31/0/0

AWAITING ADVANCED

TRAWING FOUR 22/0/0/0

TOTAL ADVANCED 22/0/0/0

GRAND TOTAL 60/31/0/0

CNATRA 1542/66 (8-73) (BACK)

81

CNATRA 1542/36 (REV. 8-72)

WEEKLY AVIATION STATISTICAL REPORT

WEEK ENDING 21 MARCH 1976

CNATRA Report 1542-7

SQUADRON		STUDENTS		INSTRUCTORS							AIRCRAFT							NON PIPELINE STUDENTS	
		SYLLABUS HOURS		AVERAGE ASSIGNED	AVERAGE IN FLT STATUS	% IN FLT STATUS	STUDENT INSTR HOURS		TOTAL AVIATOR HOURS		AVERAGE ASSIGNED	AVERAGE IN COMM.	% IN COMM.	SYLLABUS A/C HOURS		TOTAL A/C HOURS		REF OTHER	
		WEEKLY	CUMULATIVE				WEEKLY	CUMULATIVE	WEEKLY	CUMULATIVE				WEEKLY	CUMULATIVE	WEEKLY	CUMULATIVE	INPUT	ON BOARD END
		(29)	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)
BASIC NFO	T2	219	7057								22	16	73	219	7057	237	7819		
VT10	T39	320	10714	43/42	77	91	425	13414	389	13022	9	5	56	103	3604	116	3967		
ADVANCED NAV NFO																			
VT29	T29	247	9675	/8	8	100	111	4652	111	4652				37	1553	37	1553		3
ADVANCED NFO	TA4J	31	1039				69	1912	69	2326	9	6	67	69	2081	69	2343		
VT86 RIO	T39	160	5297	27/35	56	90	244	4177	90	2375	8	7	88	122	2080	77	2259		
AJN	T39	190	5952				154	5818	114	3805	8	7	88	77	2888	95	3439		
SUB TOTAL		1167	39734				1003	29973	773	26180				627	19263	631	21380		
PG																			
VT29	T29	198	2539	16	15	94	40	724	56	1622	5	2	40	20	343	28	783		
JTTU	TA4J	32	1285				30	1269	38	1743				32	1330	41	1797	/1	/2
TOTAL HOURS JET/PROP/HELO/NFO		7976	289613				6924	249004	8603	330469				7710	280497	8782	334222		
HCT16	HH46A															88	3388		

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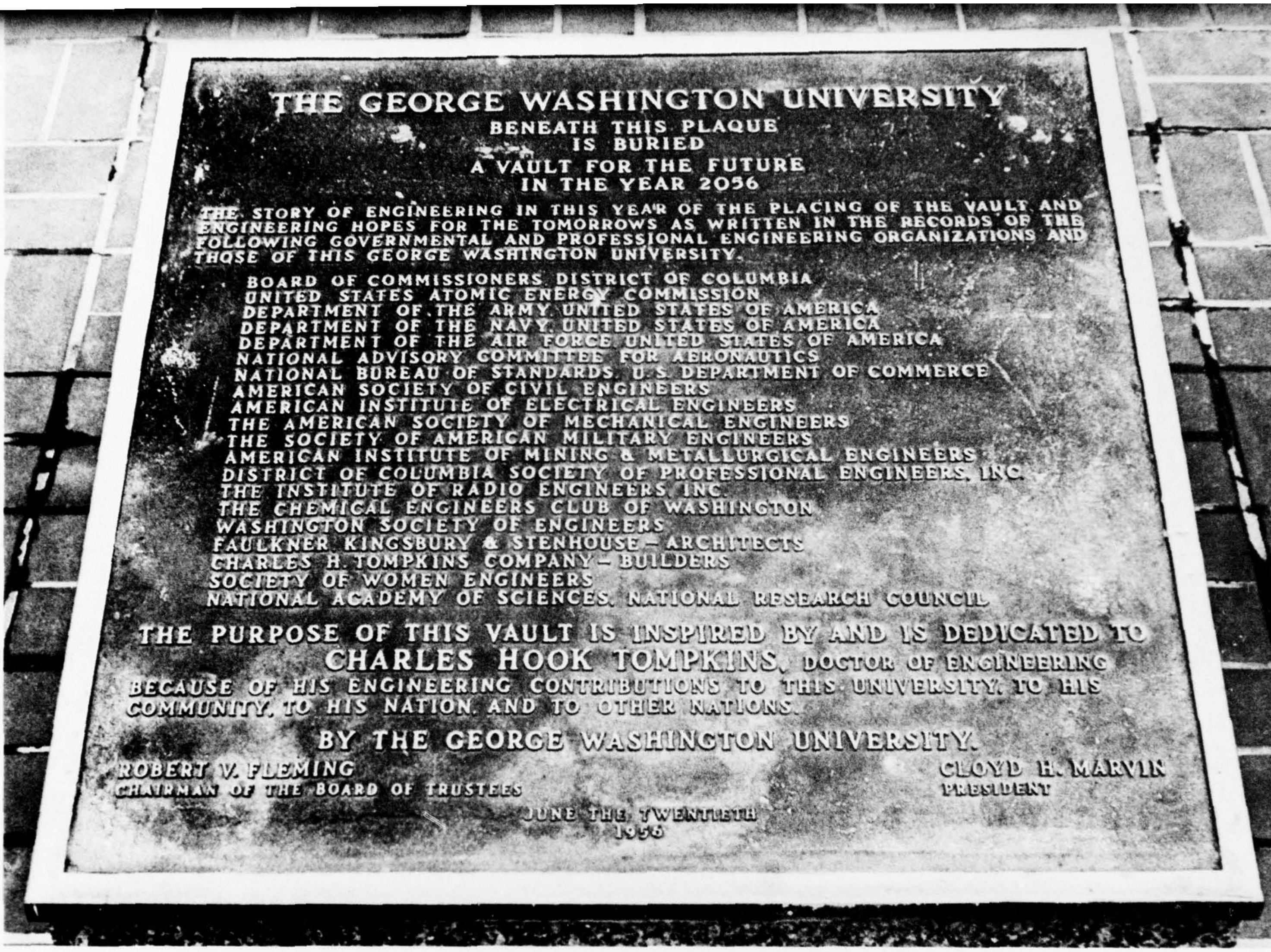

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